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RADIO NEWS

Buy your New Set
from the Man Who Knows Radio Best

—Your Community Radio Dealer

Did you know that radio reception characteristics vary widely in different localities?

Did you know that extremely slight misadjustments in the installation of your receiver can seriously reduce the quality of its performance?

And can you play doctor to your radio to correct such troubles? Perhaps not—but neither can your blacksmith—or your grocer—or your druggist.

That is why it pays to turn over all your radio problems to the man who KNOWS Radio—your community radio dealer. He has the knowhow and equipment to do a professional maintenance job on your present radio. He knows the kind of an antenna installation that will serve you best. You can trust his years of experience when you are ready to select a new trouble-free set.

Incidentally that same experience and knowhow have already led thousands of community radio dealers to choose the Meck Franchise. The superior quality of Meck Radios, from the chassis up, is readily apparent to these men who know radio best. Ask your Radio Dealer—Today.

FACE TO FACE RECEPTION

MECK RADIOS

JOHN MECK INDUSTRIES, Inc. • PLYMOUTH, INDIANA, U. S. A.

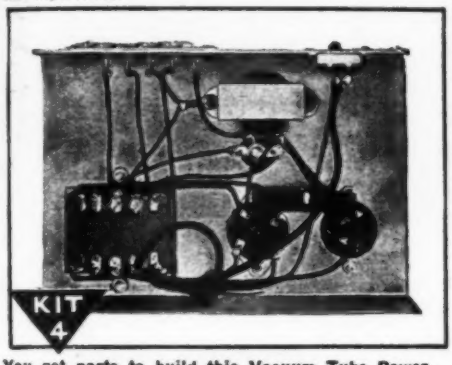
I Will Show You How to Learn RADIO by Practicing in Spare Time

I Send You 6 Big Kits of Radio Parts

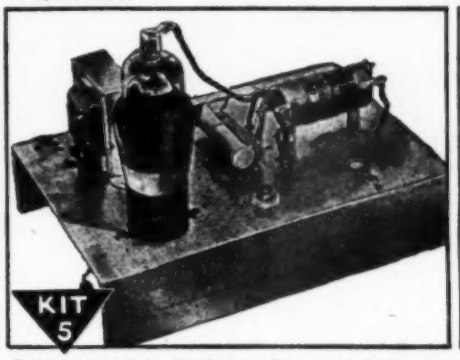
I send you Soldering Equipment and Radio parts; show you how to do Radio soldering; how to mount and connect Radio parts; give you practical experience.

Early in my course I show you how to build this N.R.I. Tester with parts I send. It soon helps you fix neighborhood Radios and earn EXTRA money in spare time.

You get parts to build Radio Circuits; then test them; see how they work; learn how to design special circuits; how to locate and repair circuit defects.



You get parts to build this Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds; learn to correct power pack troubles.



Building this A. M. Signal Generator gives you more valuable experience. It provides amplitude-modulated signals for many tests and experiments.

You build this Superheterodyne Receiver which brings in local and distant stations—and gives you more experience to help you win success in Radio.

I Will Train You at Home – SAMPLE LESSON FREE

Let me send you facts about rich opportunities in Radio. See how knowing Radio can give you security, a prosperous future. Send the coupon for FREE Sample Lesson, "Getting Acquainted with Receiver Servicing," and my FREE 64-page book, "Win Rich Rewards in Radio." See how N.R.I. trains you at home. Read how you practice building, testing, repairing Radios with SIX BIG KITS of Radio parts I send you.

Future for Trained Men Is Bright in Radio, Television, Electronics

The Radio Repair business is booming NOW. There is good money fixing Radios in your spare time or own full-time business. Trained Radio Technicians also find wide-open opportunities in Police, Aviation, Marine Radio, in Broadcasting, Radio Manufacturing, Public Address work, etc.

Think of the boom coming now that new Radios can be made! Think of the backlog of business built up in ALL branches of Radio! Think of even GREATER opportunities when Television and Electronics are available to the public! Send for free book now.

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The day you enroll I start sending EXTRA MONEY JOB SHEETS to help you make EXTRA money fixing Radios in spare time while learning. You LEARN Radio principles from my easy-to-grasp Lessons—PRACTICE what you learn by building real Radio Circuits with Radio parts I send—USE your knowledge to make EXTRA money in spare time.

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DECEMBER, 1945

RADIO NEWS

REG. U.S. PAT. OFF.

VOLUME 34, NUMBER 6

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Cover Photo
By Frank Ross

Laboratory test on the 10AP4 type cathode-ray tube at the National Union Tube Company's Landsdale, Pa., plant. This test set-up measures the engineering performance of the tube under actual load and operating conditions.

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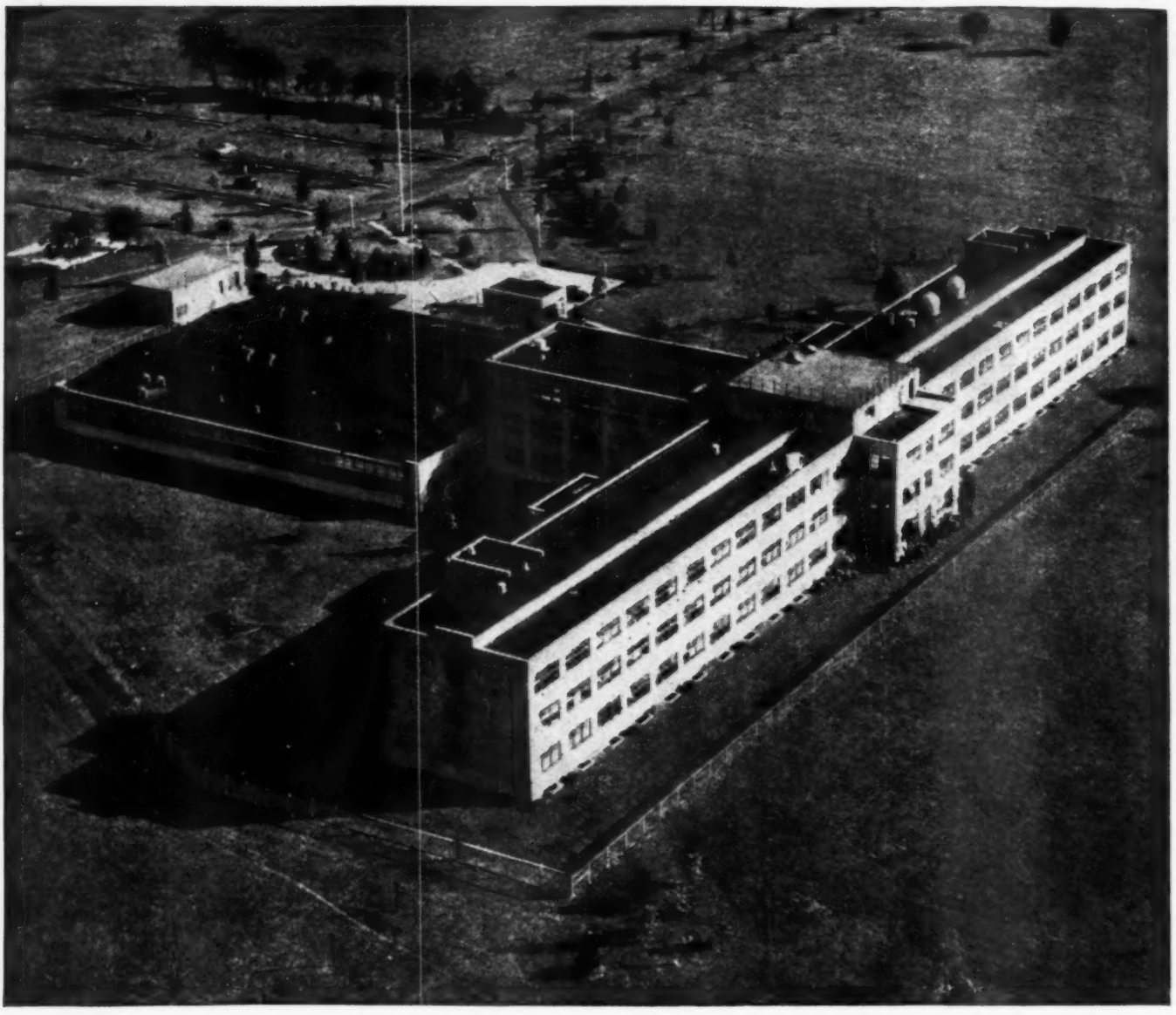

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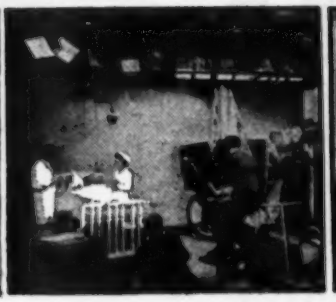

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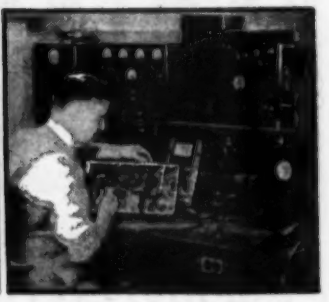

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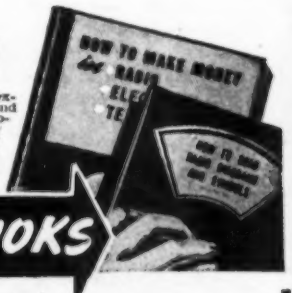

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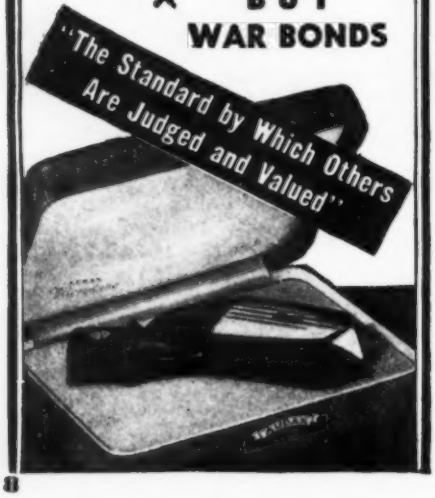

For the RECORD

BY THE EDITOR

TO LICENSE or not to license? This is an eternal question, as inevitable as death or taxes in any industry involving the work of skilled technicians whose services are required in maintaining or repairing devices owned by the general public.

The controversy usually rages around the benefits to be derived from licensing. Will it benefit the public by protecting them from inept or unscrupulous technicians? Will it benefit the technicians by protecting them from incompetents in their own ranks?

The hope of one sector of those favoring licensing is that it will raise the standards of their profession. Others, although unwilling to admit it, would like licensing because they feel it would limit competition and relieve them of the pressures implied by any competitive struggle.

The opponents are individualists who want no regulation which would impose limitations. They feel they can run their business successfully without having a license authority as a partner.

A reasonable analogy to the problem as it affects radio servicemen is to be found in the field of independent automobile mechanics. It differs in one major consideration. The auto mechanics are, in vast numbers, employees while the radio servicemen are predominantly independent business men, owners.

Some of the thinking in the field of automotive technicians is pointed up in an article in the October issue of *Automotive Digest* wherein the author points out on the plus side that the public would benefit by protection against incompetents damaging cars, and would gain financially, as it costs less to hire a skilled worker who can finish a job more quickly with less likelihood of having to do it over again. The mechanics would gain by raising the standards in their trade to at least a semi-professional level resulting in more pay because of the improved skill required to obtain and sustain a license. A licensing system would encourage an apprenticeship system. The effect would be to stabilize the auto mechanic labor market.

On the side of disadvantages, the public might have to pay more for the higher quality service they received and might not care to pay such premium.

Administration of a licensing program would require Federal supervision which means bureaucratic control leading to possible stagnation. Political domination could lead to *selling* of licenses to the *right people.*

The complexities of the industry itself would necessitate a variety of licenses for specialists.

The license requirement might act as a bar to men wishing to start in business, tending to make the field a monopoly for those already established.

Determining the standards to be met and fairly measuring each applicant's ability in terms of such standards would be most difficult.

So we find in the automotive industry the same dilemma which rears its horns in the radio service profession. No matter where we face the debate, it always boils down to administrative difficulties. Licensing must produce a condition fair to the public, fair to the profession, and fair to those who might choose to enter the profession as a life work.

THE cold bleak atmosphere which pervades the radio industry is well attuned to the weather as the November sheet appears on our calendar. The storm of protest which swirls about decisions of the OPA wreaks havoc with our hopes of a merry radio Christmas. Parts manufacturers, ill pleased with their prospects of profits, have dammed up the flow so that the few components which trickle through to receiver producers are insufficient to start the flow of even semi-normal production. Not that receiver men are eager to produce, for they too are discontented with ceilings permitted to them.

The prospect of dealers having to absorb the advanced costs has raised another storm of protest. We have no doubt that the clouds which blanket the industry will break away, but the prospects of shelves and show windows full of gleaming new radios for the Christmas season are dull indeed.

THE service man hasn't been relieved of a single ounce of the heavy responsibility to the radio owning public which he carried so stoutly during the war years. With an adequate supply of receivers still only a fond hope, the assurance of hearing fine Christmas music in the homes of America lies in the ability of the service profession to cope with the demand for repairs.

LONG and loud has been the wailing about the plight of the set maker, but what of the instrument manufacturers who also depend on an adequate flow of parts. Paralysis of this sector of the industry adds to the problems of the service man. Too long

(*Continued on page* 157)

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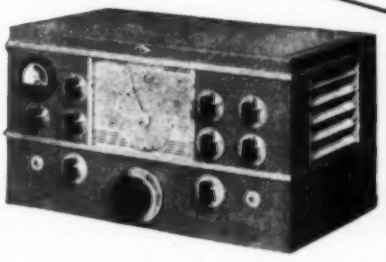

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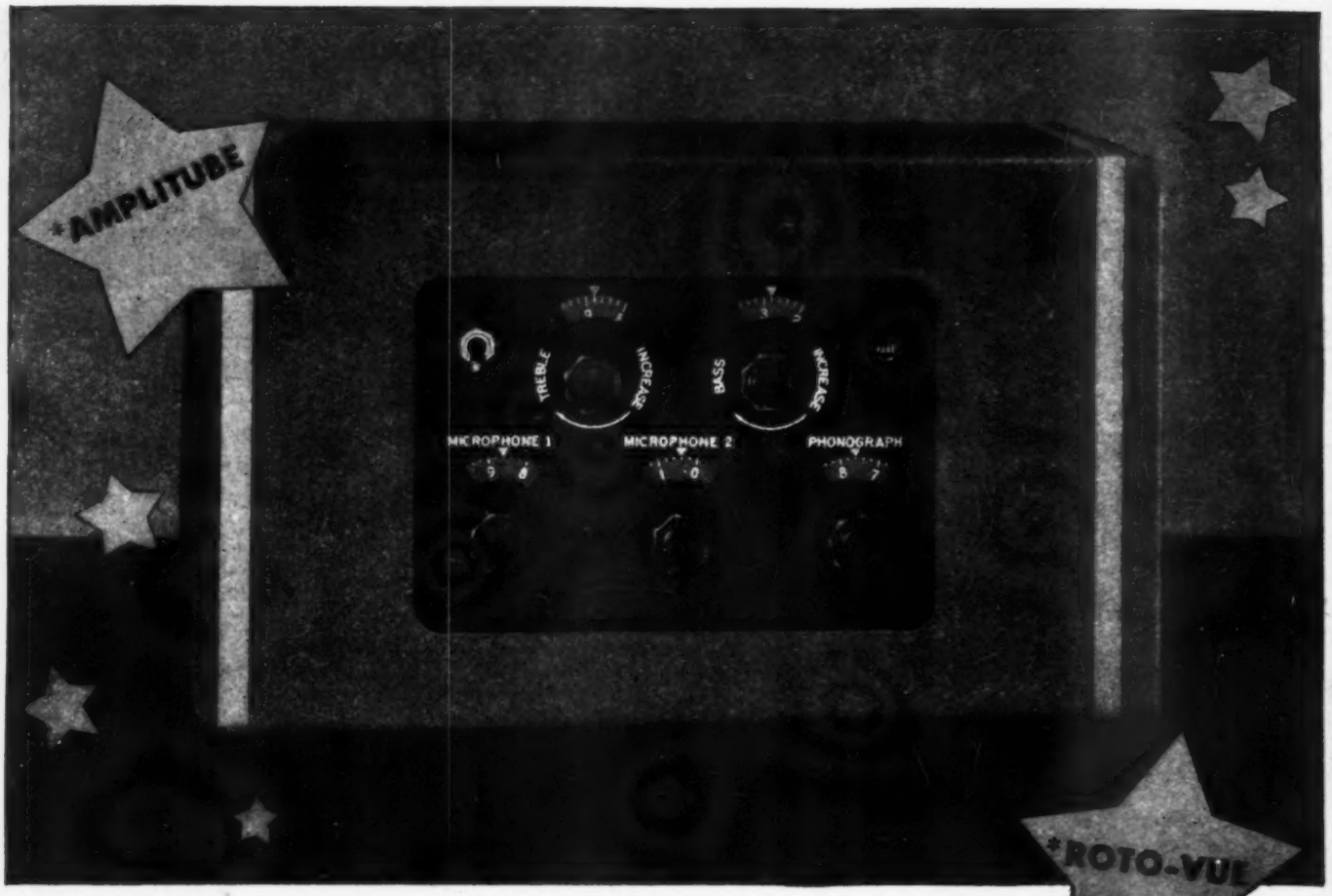

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Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By FRED HAMLIN
Washington Editor, RADIO NEWS

TO THE FEDERAL COMMUNICATIONS COMMISSION, V-J DAY brought the heaviest load of work in that agency's busy history. Applications for station licenses flooded in almost before the dust had settled from the last atomic bomb, the FM allocation problem pressed for solution, and the regular load of FCC work generally became heavier. By early October, the schedule had become so crowded that, in an unprecedented announcement, the Commission explained frankly that it was overworked and under-staffed and would therefore have to postpone hearings on clear channel broadcasting in the standard broadcasting band until the first of the year.

To give you an idea of the present FCC boom—and it may be considered a preview of the coming postwar boom in radio—more applications for new station licenses were filed in the six weeks after the war than there are AM stations operating currently in the U. S. under FCC permits. There are 950 of these last. By mid-October, new applications were filed for 677 FM stations, 412 standard stations, and 133 television installations.

Also by mid-October, FCC officials came up for air long enough to express the hope that a majority of the applications, if not all of them, would be on their way to final decision by year's end. They added that this will not lighten the Commission's work load. The problem of drawing up rules for the regulation of television was still current at the time of the announcement and there was also the herculean task of preparing for the coming world radio conference, tentatively planned for next spring.

FCC ACTIONS SINCE V-J DAY indicated that applications are being processed rapidly and one policy trend is perhaps worth more than passing notice. Applicants for experimental television stations and FM developmental stations must present a whale of a convincing case before a license is granted.

Without deprecating experimental work, the Commission pointed out that *a genuine program of research* in which a station was needed would have to be indicated. Only two applications, out of a set of more than a dozen, were granted as the policy was laid down. The alternative for some experimenters, the Commission suggested, would be *a 30-day-or-less authorization to operate a station, which can be applied for under Section 1.365 of the Commission's rules.*

The Commission added that it was "fully aware of the fact that there exists a need for developmental work regarding the higher frequency channels for commercial television broadcasting stations and that there exists a need for FM developmental work on the frequencies between 88-108 megacycles to which this broadcast service is assigned."

FRIENDLIEST RECEPTION BY FCC during the hearings on FM frequency allocations was given to the proposal by the *Columbia Broadcasting System* which favored increased coverage and a greater degree of equality among FM stations in the northeastern states. The *CBS* plan, presented by Vice-President Joseph H. Ream, broadened average New York City station coverage from 6170 square miles to 6710 square miles and the average coverage of all stations in the northeastern area from 8770 square miles to 9010 square miles.

"The total increased coverage of all stations in the area would be approximately 40,000 square miles," Mr. Ream pointed out, "and this is equivalent to providing channels for five additional stations with a coverage of 8000 square miles each."

The *CBS* plan would give stations in each metropolitan district coverage areas which are more nearly equal. Station managements, according to Mr. Ream, would also be encouraged to concentrate on better programming.

As this goes to press, FCC engineers were going over sixty maps and other data submitted by *CBS* engineers under their director of general engineering, William B. Lodge.

SPEAKING OF FCC AND ENGINEERS, Commission sources report a *tragic shortage* of radio engineering talent. For anyone with postwar job plans in that direction, there are a number of openings. Top government radio engineers get $9000 annually.

Although openings will be slower developing in the industry, a spot check with employer representatives of private industry in Washington in-

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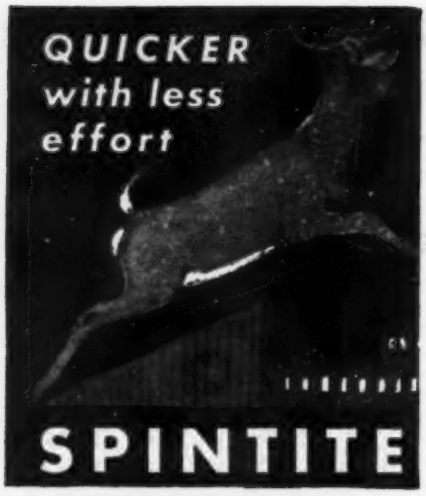

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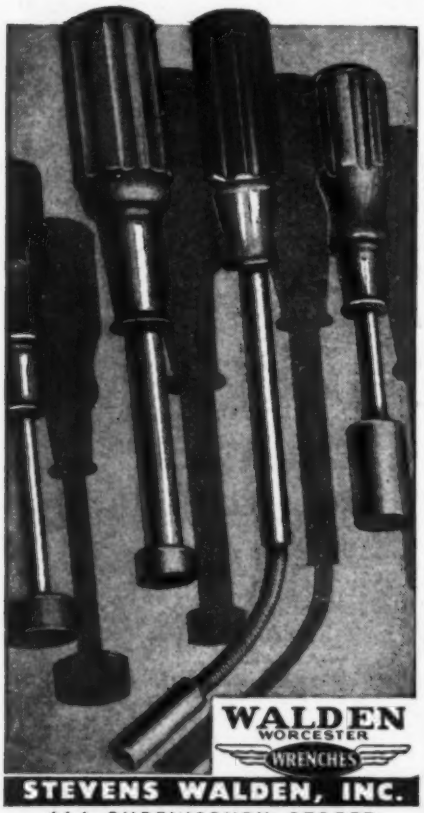

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dicates that there will be a job boom in the radio engineering field all along the line and RMA reports that a number of industry-financed training programs are being planned.

FCC is not optimistic about GI Joe's chances of starting his own station. Competition already shows signs of being very extensive and costs are as high as risks. This applies particularly to the comparatively small FM stations. Says FCC Commissioner Clifford J. Durr:

"The cards are stacked in favor of present broadcasters and against newcomers by the fact that the newcomer will have to bear the expense of programming his FM station, while the present broadcaster need merely broadcast over his FM station the same programs he is already carrying over his standard broadcasting station.

"If the newcomer happens to be in the armed service, his plight is even more difficult, for he not only faces the economic disadvantages common to all newcomers but, the date of his return to civilian life being uncertain, he is not in a position to plan intelligently or even prepare and file his application."

INTERNATIONAL RADIO COMMUNICATIONS and the equipment to implement them will rest on a firm foundation of world-wide agreements by the end of 1946 if work already well under way at FCC and the State Department is successful. The odds, according to Washington observers, are that it will be.

This is not to say that all will be smooth sailing in drawing up the agreements, either at home or abroad. State Department is still bothered domestically by a lack of unity among U. S. radio leaders and there seems little likelihood that all dissension will disappear as the international negotiations go forward. But "State" is not pessimistic about the ultimate outcome of world radio amity.

"Never before," says Francis Colt de Wolf, chief of State's telecommunication division, "has there been closer integration between government and industry. I feel confident that we will ultimately reach solutions which will prove acceptable to all the users of the radio spectrum, although they may not obtain 100 per-cent of all their demands."

Not inconsiderable progress was reported following the often postponed third inter-American radio conference in Rio in September and, although the suggested revisions of the Cairo General Radio Regulations which came out of Rio were all tentative, the Havana convention agreements were revised and the revisions accepted. Speeding up the work has also, of course, been appreciable now that the world is at peace and although defeated countries will not have major roles in the coming meetings, it will be possible more clearly to define their postwar places in the world radio picture as well as to complete radio regulations governing the vanquished.

Two major troubles are anticipated before postwar international radio amity is accomplished. One is the tremendous size of the job itself, now further complicated by aviation radio's obviously important postwar role. The other is the difficulty expected in getting radio leaders of all nations involved together for meetings. Such leaders—including our own—are operating on such crowded schedules that it is difficult to anticipate an international meeting before spring at the earliest. But a major gathering is being planned tentatively, and State Department experts are optimistic that most major difficulties will be ironed out within the year.

RECEIVING EQUIPMENT FOR COLOR TELEVISION will be one of the outstanding developments on the domestic calendar early in the new year. Authority for this statement is Dr. Peter Goldmark, television engineer for the *Columbia Broadcasting System*.

"Receiver development, both direct-viewing and projection, is now being carried out in our laboratories," he said. "The *General Electric Company* recently entered into a cooperative agreement whereby they will take *CBS* receiver developments and turn

(*Continued on page* 147)

Table 1. The old and new increase factors that may be used to calculate manufacturers' ceiling prices on radio tubes and parts, sold for use as original equipment.

	OLD Increase Factor	NEW Increase Factor
RADIO RECEIVING-SET TUBES	10.4%	10.4%
COILS FOR RADIO EQUIPMENT	11.0%	26.3%
RADIO TRANSFORMERS AND CHOKES	11.0%	16.1%
VARIABLE CAPACITORS	9.0%	13.5%*
SPEAKERS AND SPEAKER PARTS	9.0%	13.5%
FIXED CAPACITORS	7.0%	16.4%*
PARTS FOR ELECTRIC PHONOGRAPHS AND RADIO-PHONOGRAPH COMBINATIONS	7.0%	11.5%
RESISTORS, ALL TYPES	5.0%	9.5%
ALL OTHER RADIO PARTS, AS COVERED BY MAXIMUM PRICE REGULATION 136—MACHINES, PARTS, AND MACHINERY SERVICES, AND NOT EXPLICITLY COVERED ABOVE	5.0%	9.5%

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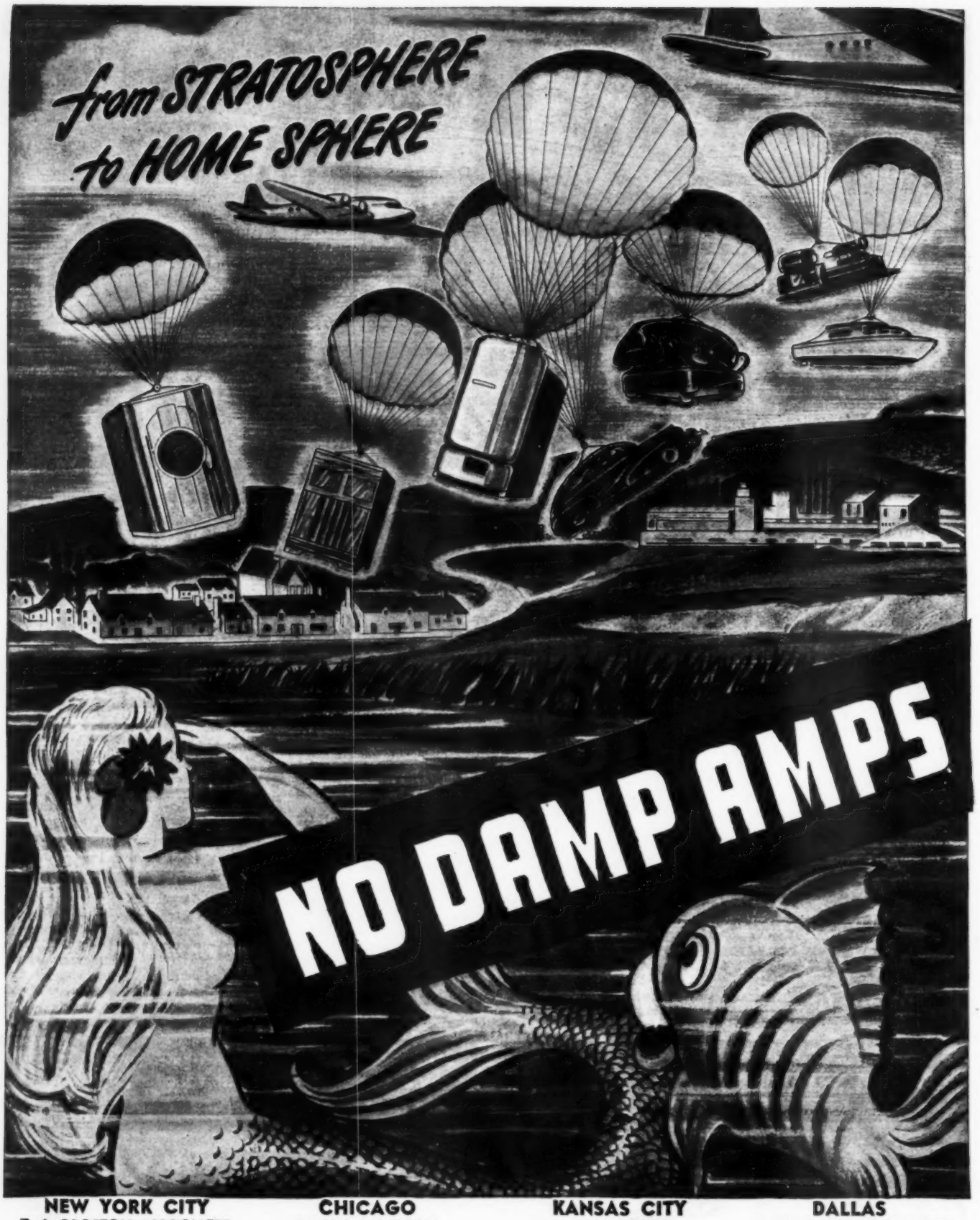

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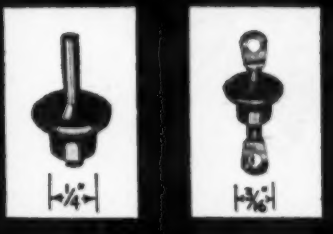

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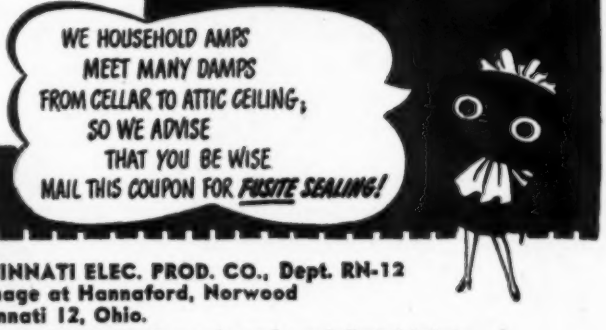
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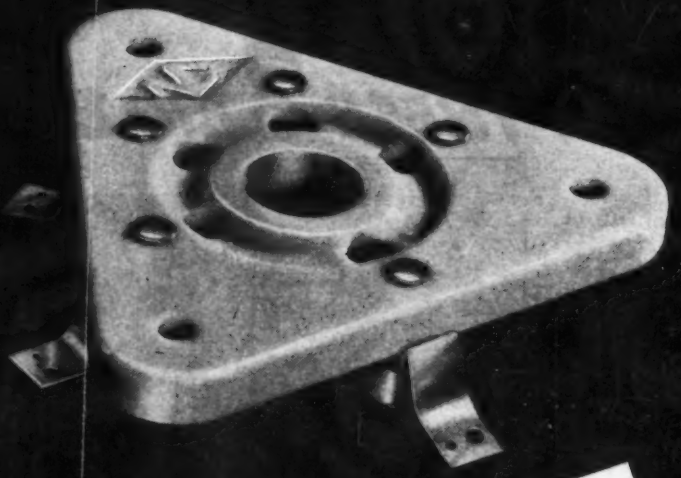

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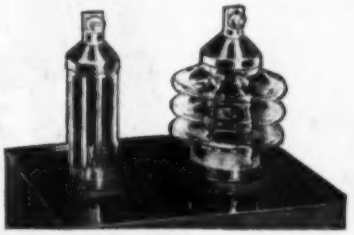

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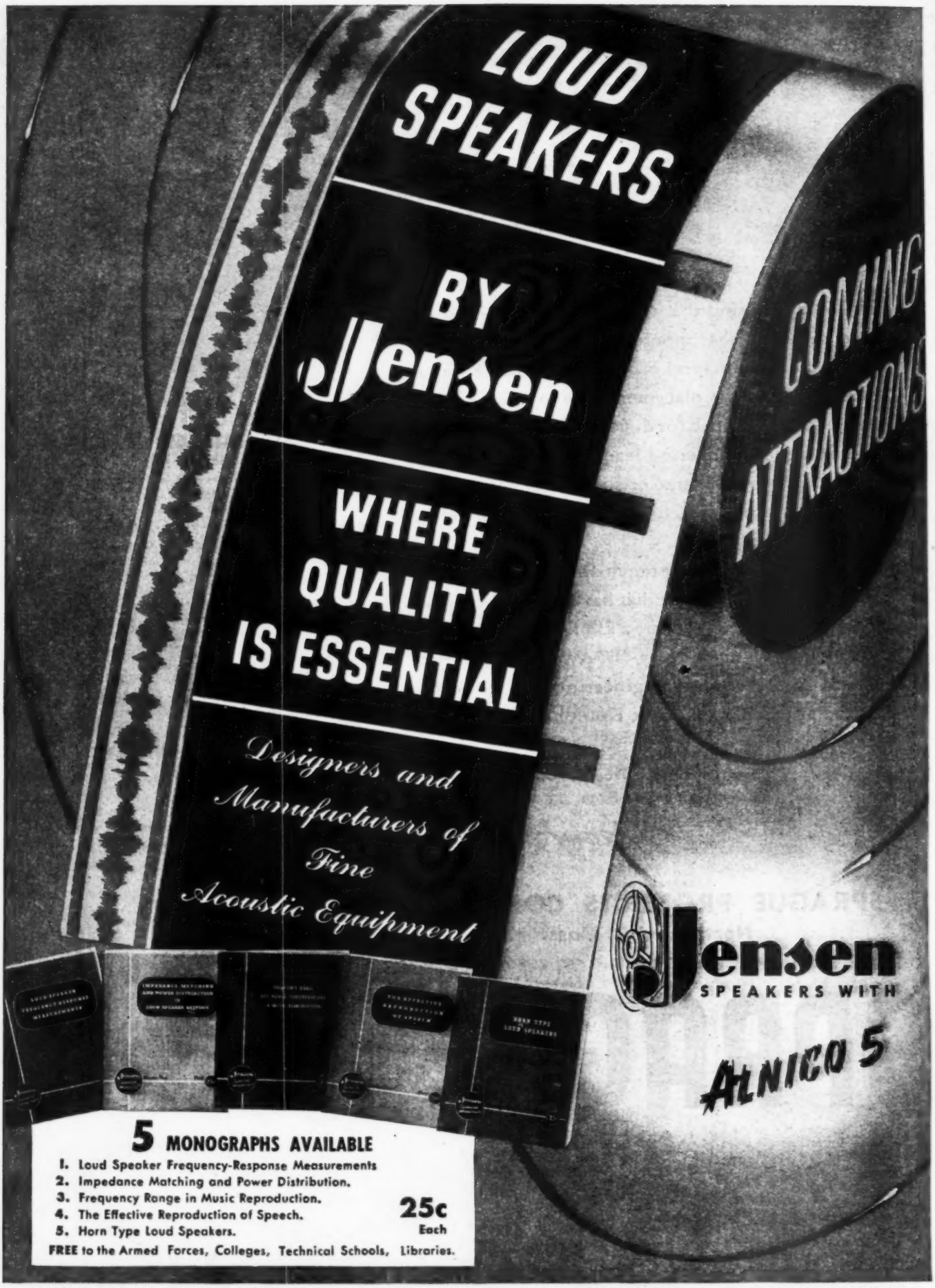
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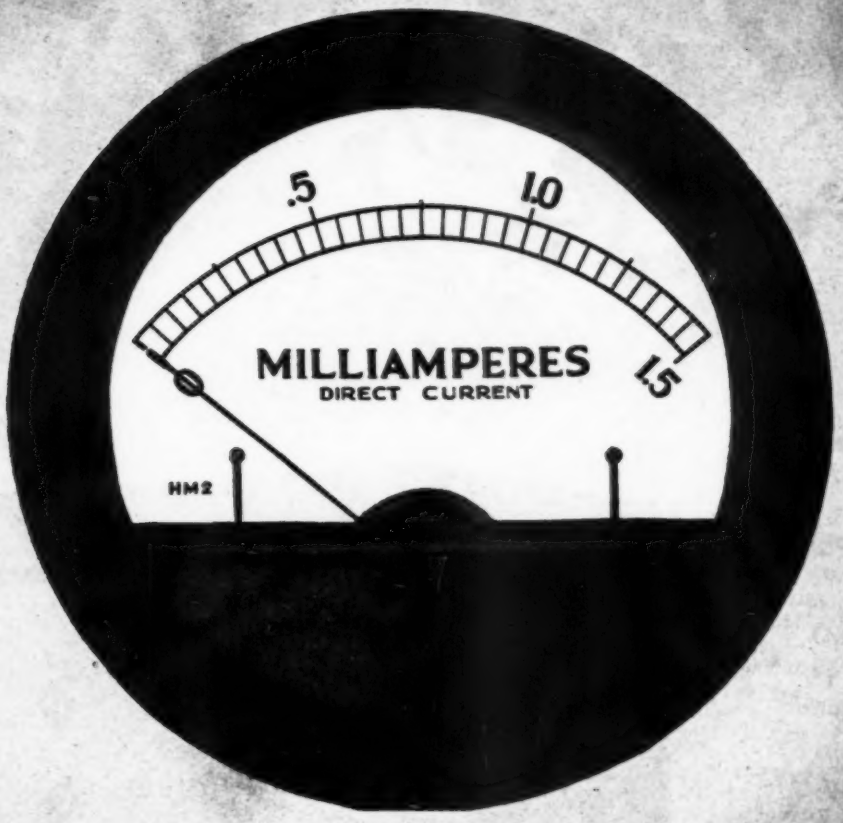

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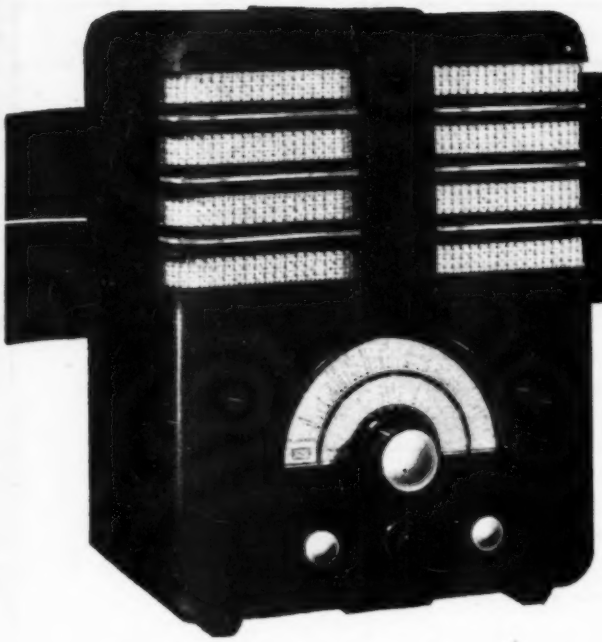


Plastics in RADIO

By LEON LADEN
London, England

Imbedded with thin strips of decorative aluminum phenolic, this table model cabinet with control knobs of urea material probably indicates the trend of future developments in mixed plastics and metalized-plastics combinations.

Thermosetting plastics, long established for use in radio, television, and allied fields, are now rapidly giving way to the newer thermoplastic materials.

Polythene injection molded formers and bobbins are typical of the many uses to which this tough, solvent-resistant material of very low specific gravity lends itself. To the right is shown a vital radar component molded from polystyrene. This photograph was enlarged to bring out the intricacy of design and cleanness of finish obtainable with this resin. Polystyrene, a hard, glass-clear and water-white resin combines the lowest relative power loss with the highest dielectric strength.

LOOSE publicity visualizations of all-plastics radio and television receivers rolling from gigantic presses in similar fashion as ash-trays or beakers inevitably portray as much ignorance of the basic principles governing radio-electronic operations as plastics tools and applications. Coupled, however, with commercially marketed present-day plastics radio products still suffering from toothing trouble or downright unsuitable for use, such flagrant pipe dreams tend to tax severely the patience of a good many people in the radio industry.

But while it is common knowledge, of course, that thus far only radio cabinets and sectional parts of radio-electronic component assemblies can be molded or fabricated from synthetic resins, realization is less general that breakdowns and failures of finished plastics radio parts are normally more attributable to improper material selection and/or inept process working than to those twin catch-phrases "dimensional instability" and "inherent incompatibility to comply with accuracy requirements," so familiarly applied to these materials of the modern age to explain away shortcomings of all sorts.

In fact, the case for the use of plastics in the radio industry is clear cut and based on a tremendous record of valuable service rendered from plastics' pioneer days onwards in a wide and varied range of selected applications in which the physical properties of thermoplasticity—which gives these materials their special manipulative value—could be exploited in combination with their excellent electrical and mechanical properties for manufacturing operations geared to mass production.

Furthermore, once irresponsible publicity stunts, poor-quality products, and occasional misapplications are discounted, it becomes obvious that plastics resins applied to radio have improved the appearance, comfort in handling, uniformity of performance, or length of service of innumerable components as well as effected revolutionary changes in the design and construction of radio-electronic equipment varying from multitube communications sets and airborne aviation units to midget receivers and personal portables.

Material Considerations

Already plastics materials used in the radio industry include practically every existing compound derived from coal, petrol, and natural gases or built up by chemical synthesis, comprising equally thermoplastic resins that can be replasticised (melted) again after molding and thermosetting resins which cannot.

Despite the fact, however, that both thermoplastics and thermosetting materials are undoubtedly similarly built up from constituent elements linked together selectively in long chains of carbon atoms in association with hydrogen, oxygen, nitrogen, chlorine, etc., the preferential choice of any particular resin for application to specific radio-electronic requirements is extremely difficult to make since most plastics are complementary to one another but individually fail to cover the required range.

This is borne out by the long-estab-

			PROPERTIES REQUIRED												MATERIAL															MANUFACTURING METHOD			
	GROUP	PLASTIC RADIO PART	MECH. STRENGTH	APPEARANCE	H.F. POWER LOSS	HEAT RESIST.	INSULATION	WATER RESIST.	DIMENS. STAB.	ACCURACY	MOULDED	CAST	LAMINATED	PHENOLIC	UREA	MELAMINE	POLYTHENE	CELLULOSE AC-BUT.	POLYSTYRENE	METH. METHACRYLATE	VINYL MAT.	VINYLIDENE CHL.	MOULDING	COMPRESSION	TRANSFER	INJECTION	LAMINATION	CASTING	EXTRUSION
1	EXTERNAL	RADIO CABINET	X	X							X				X				X				X		X						
2		KNOB								X	X				X				X				X		X						
3		ESCUTCHEON	X	X							X				X				X				X		X						
4		BACK COVER								X	X				X				X				X		X						
5	HIGH FREQUENCY	VALVE HOLDER & BASE	X		X	X	X	X	X		X				X				X				X		X						
6		H. F. COIL FORMER			X	X	X	X	X	X	X				X				X				X		X						
7		DISC SWITCH			X	X	X	X	X		X				X				X				X		X						
8		H. F. CABLE PLUG	X		X	X	X	X	X		X				X				X				X		X						
9		CRYSTAL HOLDER			X	X	X	X	X		X				X				X				X		X						
10		SLEEVINGS, TUBES, RODS			X	X	X	X	X		X				X				X				X		X						
11	LOW FREQ.	L. F. COIL FORMER	X				X	X	X		X				X				X				X		X						
12		TAG PANEL	X				X	X	X		X				X				X				X		X						
13	MAIN VOLTAGE	MAIN PLUG & SOCKET	X				X	X	X		X				X				X				X		X						
14		CONTROL PANEL & TERMINALS	X				X	X	X		X				X				X				X		X						
15		INSULATED CONTROL SPINDLE, COUPLING	X				X	X	X		X				X				X				X		X						
16		MAIN SWITCH BODY	X				X	X	X		X				X				X				X		X						

Courtesy of E. K. Cole Ltd., Southend-on-Sea, England

Typical applications of plastic radio components and parts are illustrated by this table. Properties required, materials used, and manufacturing methods employed are grouped separately to facilitate identification.

lished thermosetting type phenol-formaldehyde and urea-formaldehyde resins for extensive usefulness in radio, television, and allied fields, which have a higher relative heat resistance (about 250°-300°F.) than such thermoplastics as polystyrene and polythene (both of which will lose over 10 percent of their mechanical strength or become affected in appearance at a temperature of 140°-190° F. at no load and 120°-170°F. under mechanical load) but at the same time also have a higher water absorption and a correspondingly lower electrical resistivity than the almost non-water absorbent thermoplastics, which remain practically unaffected by moisture and consequently possess a higher resistivity.

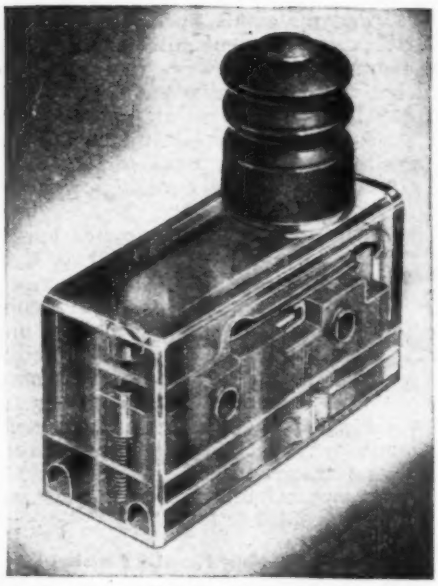
However, continued progress in selecting, arranging, constructing, and controlling molecular structure aggregations and methods of molding, laminating, casting, and extruding resinoid substances under the influence of heat and pressure is making it increasingly possible to produce plastics materials combining what is most useful and advantageous in both thermosetting and thermoplastics resins from the radio-electronics point of view.

These newer resins, generally belonging to the thermoplastics group, are enabling rapid headway to take place in the production of plastics radio parts, components, and accessories possessing a low power factor, a high dielectric constant, a negligible temperature coefficient, and great mechanical strength in addition to being immune from cracking, durable, interchangeable, usage-resistant, non-water absorbent, fire-proof, dust-proof, vermin-proof, mold-and-mildew-proof, and a host of other "proofs".

Plastics Radio Applications

Of course, everyone is familiar with dark-brownish or opaque colored molded or fabricated phenol-formaldehyde control switches, connectors, multiple plugs, intercommunicating sockets, etc. Nor is there much object in enumerating in detail the abundant varieties of control knobs, escutcheons, or main switches made from such other thermosetting resins as urea-formaldehyde and melamine-formaldehyde resembling in their properties and applications phenolics but having

Representative examples of various British radio cabinets molded or fabricated from different plastic materials. (Left) Urea table model. (Center) Leather-covered wood-plastic portable. (Right) Phenolic console.



Housed in black bakelite, this recently developed British plunger-operated, single-pole, universal switch is completely sealed against oil, dirt, water, etc.

THERMOSETTING	THERMOPLASTIC
PHENOL–FORMALDEHYDE:–	CELLULOSE ACETATE & BUTYRATE
MOULDED PHENOLICS	POLYSTYRENE
CAST PHENOLICS	POLYTHENE
LAMINATED PHENOLICS	METHYL METHACRYLATE
UREA–FORMALDEHYDE	VINYL CHLORIDE
MELAMINE–FORMALDEHYDE	VINYLIDENE CHLORIDE

Chart shows the major classifications of thermosetting and thermoplastic material compounds used at present in the radio industry.

a higher water absorption and a wider range of colors, since these and similar plastics products are equally well known to anyone engaged in the radio industry.

Less known is the fact, however, that in recent years the range covered by these thermosetting materials has been extended in volume of applications and that now resins of this type are finding new outlets as insulating binders in tuning coils, abrasion-resistant seals in capacitors, outer encasings in resistors, bag-like enclosures in chokes, protective coatings in transformers, and in a multitude of other radio components in all of which their value for ensuring high stability and close tolerance working has been proved under normal as well as specially arduous service conditions.

Of the older thermoplastics type materials, cellulose derivatives, particularly cellulose acetate and butyrate, are used to a considerable extent for the production of knobs, escutcheons, coil formers, tag panels, and sometimes, in addition, also as sealing adhesives and surface coatings. But the great disadvantage of these resins is their inflammability which despite possibilities of regulation by the aid of plasticizers and modifiers restricts their scope to radio parts that do not readily come into close contact with excessive heat dissipation.

Accordingly, newer types of thermoplastics had to be developed to meet the rigid requirements of dielectric strength, high resistance to moisture absorption, stability in varying service conditions, exposures to extremes of temperature and high humidity, mechanical strength, and chemical inertness which are all necessary factors of great magnitude for the efficient operation of radio-electronic equipment, especially in tropical and sub-tropical climates.

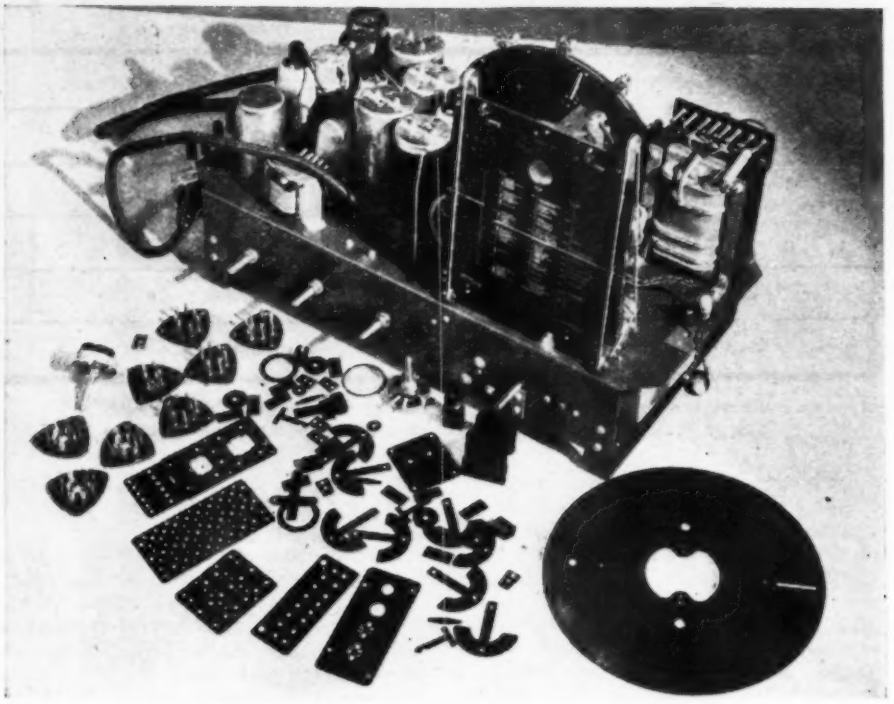
Among these newer thermoplastics, polystyrene, a hard, glass-clear, and water-white resin of entirely synthetic origin, is probably the most versatile of all plastics for application to radio work since apart from being the cheapest of all commercially available materials, it combines the lowest relative power loss (power factor .0002) with the highest dielectric strength (dielectric constant 2.5-2.6). Its uses extend over a wide field and include valveholders that can stand up to extreme vibrations without flash-over between pins or breakage through misalignment, h. f. cable plugs, coil formers, bobbins, and covers in walkie-talkies as well as tropic-proof molded paper and dry-electrolytic type condenser enclosures capable of withstanding high ambient temperatures and excessive humidity.

Another thermoplastic of comparatively recent vintage is polythene, a tough, solvent-resistant material of very low specific gravity used as a dielectric medium for condensers and for making h. f. and l. f. coil formers, l. f. cable plugs, sleevings, tubes, rods, etc. In the form of extruded interwoven filaments, this resin is also applied to increase low-loss coaxial cable insulation efficiency and as a moisture-resistant molding compound for enclosing switch assemblies, transformers, and variable-resistance gear or made into membranes in acoustic devices for excluding moisture from loudspeaker diaphragms.

Potentially perhaps the most useful of the newer thermoplastic synthetics is methyl methacrylate, a relatively little known, glass-like resin hitherto exploited only on a small scale for front covers in measuring instruments, escutcheons, sleevings, tubes, rods, and similar articles. For some time now, however, some interesting development work has been going on in molding, from this material, television camera lenses and viewing screens which, in combining smaller dimensions with a wider angle of vision than obtainable with traditional optical glass, promises to increase comfort in cinema and home television projection and viewing.

Table details the primary properties of plastic resins applied to radio-electronics. Figures quoted are approximate and vary with changes in the composition and structure of the particular material.

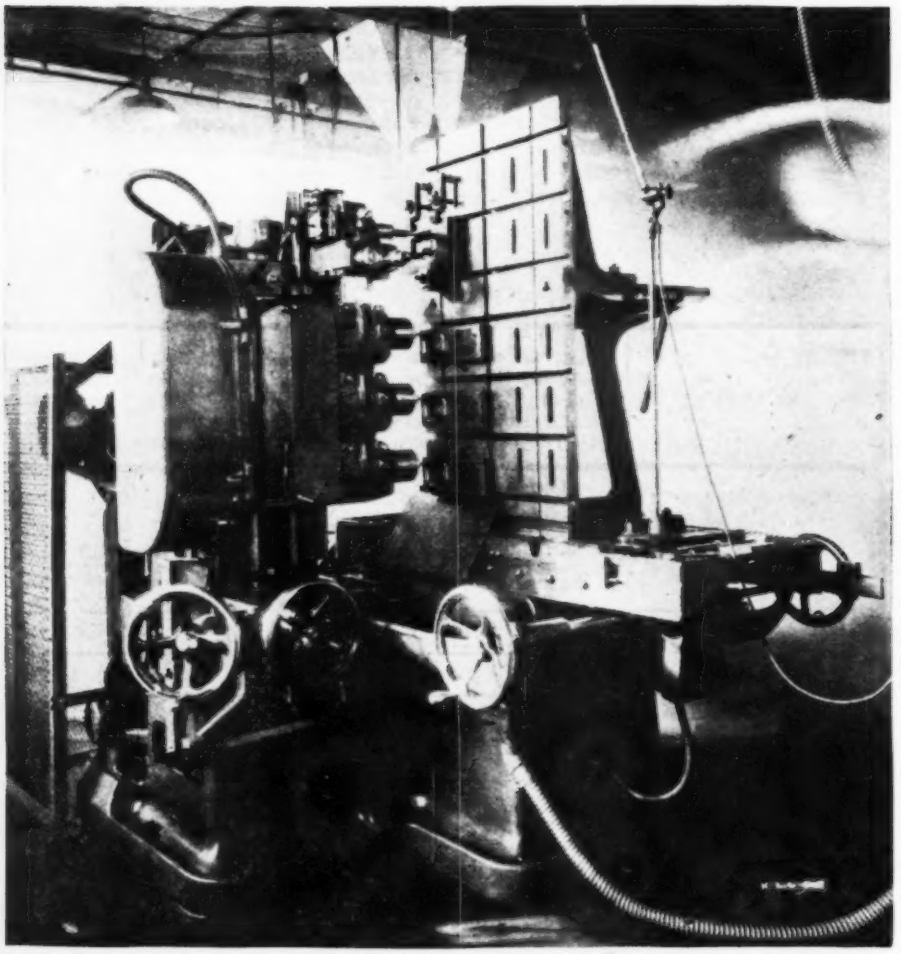
MATERIAL	DIELECTRIC CONSTANT AT 60 CYCLES PER SECOND	POWER FACTOR TAN. δ AT 60 CYCLES PER SECOND	BREAKDOWN VOLTS PER MIL	RESISTIVITY (VOLUME) OHMS PER CUBIC CENTIMETER	RESISTIVITY (SURFACE) OHMS PER SQUARE CENTIMETER
PHENOL–FORMALDEHYDE:					
STANDARD	5–12	.05–0.4	300–500	10^{10}–10^{12}	10^{9}–10^{11}
CAST	6.5–7.5	0.1–0.15	300–450	10^{10}–10^{12}	10^{9}–10^{11}
LAMINATED (PAPER)	5–8	.02–.06	500–1000	10^{10}–10^{13}	10^{9}–10^{12}
UREA–FORMALDEHYDE	7–8.8	.05–.09	600–700	10^{12}–10^{13}	10^{11}–10^{12}
MELAMINE–FORMALDEHYDE	6–9	.05–0.2	350	10^{11}	10^{10}
CELLULOSE ACETATE	3–8	.01–0.1	250–800	10^{10}–10^{12}	10^{9}
POLYSTYRENE	2.5–2.6	.0002	500–750	10^{17}–10^{19}	10^{16}–10^{18}
POLYTHENE	2.2	.0003	600	10^{17}	10^{16}
METHYL METHACRYLATE	3–3.8	.05–.07	480–500	10^{15}	10^{14}
VINYL CHLORIDE	6–12	.02–0.5	400–2000	10^{12}–10^{15}	10^{11}–10^{14}
VINYLIDENE CHLORIDE	3–5	.02–.03	500	10^{14}	–



These familiar component parts machined from laminated bakelite, a hard infusible phenolic resin of the thermosetting type, illustrate some of the better-known plastic applications in a modern British-made radio chassis.

★ ★

Available in a wide range of sizes, automatically controlled machines are used for two and three dimensional routine mold production operations.



Vinyl materials, such as vinyl chloride and vinylidene chloride, are other examples of newer thermoplastics coming into prominence in the radio industry. At present, these tough, strong, abrasion-resistant, rubber-like resins are mainly used for sleevings, tubes, rods, cable coverings, and internal wiring purposes.

But quite apart from applications in which thermosetting as well as thermoplastics resins are utilized as resinoid finishes, adhesives, coating compositions, or in sheet or molded unit form, substances like methyl methacrylate are already finding less obvious uses in demonstration models for teaching radio science and phenolic laminated sheets for depicting detailed wiring diagrams of intricate radio-electronic circuits for servicing and other purposes.

The Plastics Radio Cabinet

Radio cabinets are typical examples of major plastics radio products that can be molded or fabricated in one piece, except for the dial covering, handles and manual control knobs, by mass production methods in large quantities and at competitive prices.

Nevertheless, it is generally conceded nowadays that phenolic, urea, and cellulose acetate radio cabinets failed to meet in the past with as much success in building up good will among the public as was expected.

This was probably due to the conventional practice of reproducing in plastics console, table, portable, or midget models the run-of-the-mill effects normally obtainable in traditional materials like wood and metal instead of creating new viewpoints in appearance, engineering utility, and aesthetic appeal of form and texture through the skillful and imaginative employment of the almost limitless possibilities of color and pattern combinations to which the different plastics—and especially the newer thermoplastics—lend themselves.

Accordingly, a complete change in plastics radio cabinet designing may well be anticipated in the future, calling for the abandonment of all-plastics and wood-plastics cabinets and the development of mixed-plastics, metal-plastics, or metalized-plastics housings with laminations, inlays, imbedments, and decorative assemblies of, say, aluminum which has a specific weight comparable with plastics and offers a wide latitude of color contrasts and design diversifications.

It can also be assumed that the present trend of building unwieldy four-in-one Radiovisograms housing AM and FM broadcast, vision, and gramophone units in single, "Frankenstein-proportioned," cabinets is bound to stimulate a demand for furniture-matched, functional-appeal-with-eye-appeal-balanced, plastics-encased sets specially adapted to the styles and dimensions of modern homes.

In fact, portents of things to come in the way of plastics cabinets are al-

(Continued on page 159)

The completed unit featuring acorn tubes and separate tuning unit is available in kit form.

By ART RATTRAY
Concord Radio Corp.

Build Your Own V.H.F. FM-AM RECEIVER

The design of an unusual FM-AM receiver that covers the new FM band as well as the 2½ meter amateur band, which has been recently reopened.

THE recent FCC announcement of the new band for FM has left most home constructors in a quandary as to how best to construct a receiver for these frequencies. Obviously, the components that were used on the present band will not function satisfactorily on the higher frequency due to the additional circuit losses.

Examination of the various possibilities revealed that a kit used for training of various military personnel in the mysteries of high frequency work could be very well adapted to the needs of the new band. This kit is available complete with all components and a completely fabricated chassis, panel, and metal parts so that the only tools needed for assembly are a screwdriver, pliers, and soldering iron. Two models are offered, one covering the new FM band, 88.6 mc. to 107.6 mc., and the other covering 115 mc. to 140 mc. which will be of interest to the amateurs.

Selection of either FM or AM reception is by means of a panel switch, and the only other controls on the panel are the tuning dial, with its calibrated scale, the volume control and the a.c. line switch.

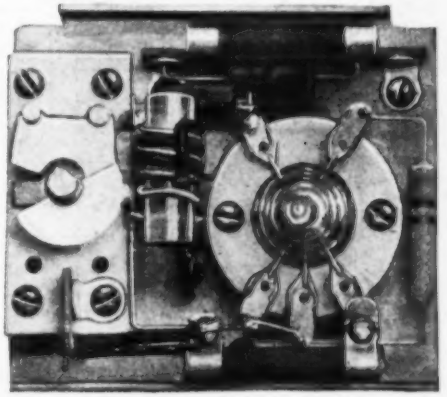
The circuit follows conventional practice, with emphasis placed on short leads, clean layout, and high gain to give maximum efficiency and sensitivity. The tube line-up runs as follows: A 956 acorn is used as an r.f. amplifier, followed by a 954 detector-mixer. The high frequency oscillator is a 955 acorn. The i.f. amplifier consists of a 6SK7 1st i.f., 6SK7 2nd i.f., and a 6SJ7 limiter or 3rd i.f. amplifier. A 6H6 is used both as discriminator and 2nd detector. The audio amplifier consists of a single 6C5. The power supply consists of a 5Y3 rectifier and OD3/VR-150 voltage regulator.

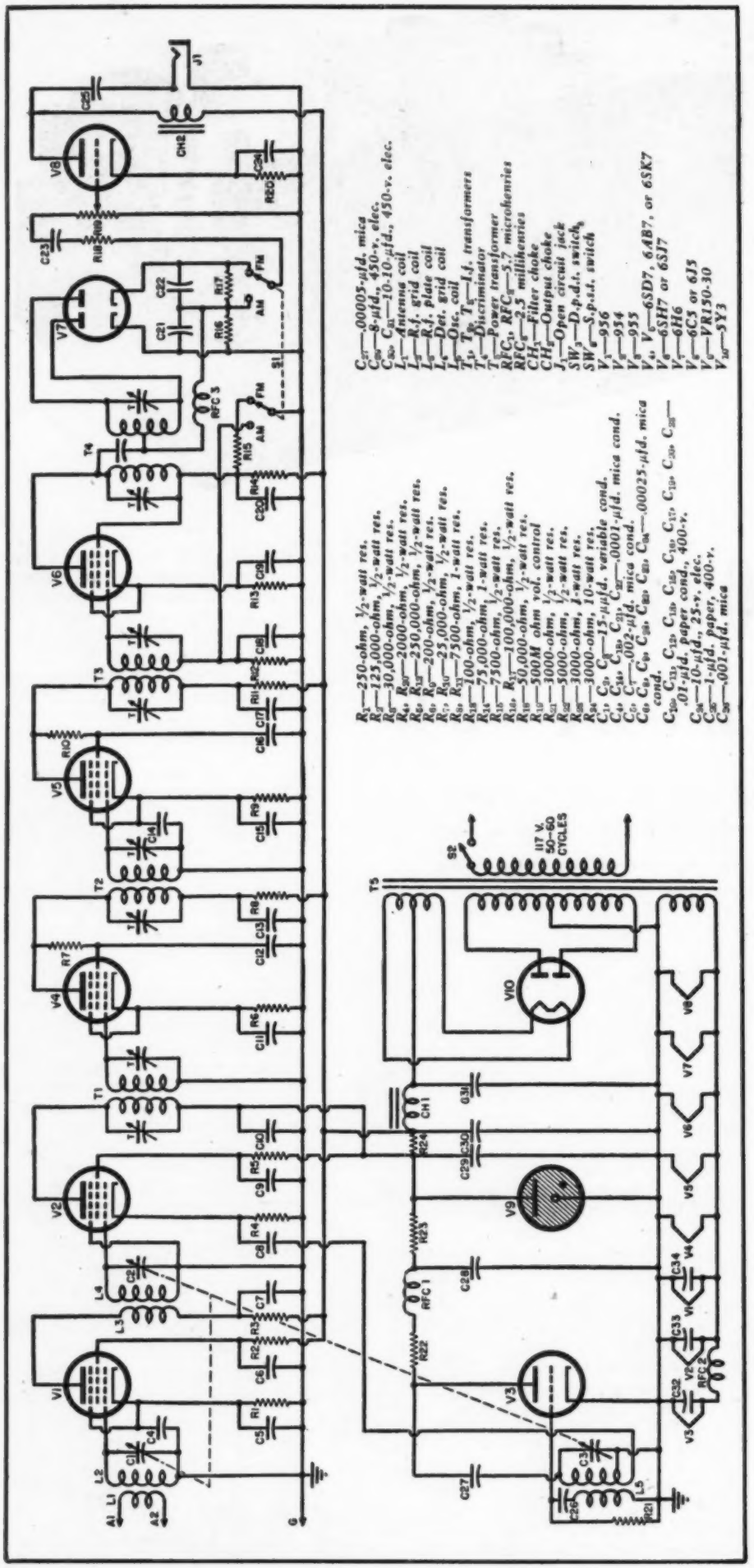
The receiver consists of two sub-assemblies, the r.f. unit measuring 3⅛"x3¾"x6" and the i.f-a.f. power supply unit measuring 10"x12"x3". After assembling and wiring the two units they are bolted together with four machine screws and electrically interconnected by seven wires. Since the kit was designed for advanced instructional purposes, all small components such as resistors and condensers are mounted on terminal strips. This gives the finished set a professional touch.

The r.f. unit consists of three shielded compartments containing an antenna stage or r.f. amplifier, mixer and oscillator with the three acorn tubes oriented from a functional standpoint. The two shield partitions and acorn sockets carry most of the components so that assembly problems are kept to a minimum by wiring up the individual stages before finally assembling the complete unit. The r.f. amplifier stage utilizes a conventional condenser tuned circuit with inductive coupling to the antenna and following mixer stage. By inductively coupling the stage, optimum coupling is obtained for best selectivity and gain as well as providing proper termination for a low impedance line to the antenna. Since there is no wiring between stages with inductive coupling, only three wires for the filament and plate supply connect to the terminal strip on the i.f.-a.f.-power supply chassis.

The mixer or first detector stage operates from the regulated voltage also supplied to the oscillator tube for stability of operation. The oscillator signal voltage is coupled to the mixer by cathode injection, the injection voltage being developed between the ground tap of the oscillator coil and the end of the coil opposite the plate end. An r.f.

Bottom view of the oscillator assembly, employing a 955 acorn tube in a plate tuned inductive feedback circuit.





gain or sensitivity control is not used in the r.f. amplifier and mixer stages as these two stages must operate at maximum gain to provide a good signal-to-noise ratio at these frequencies for amplitude modulated signals and a good quieting voltage for frequency modulated signals. The mixer tube is mounted so that the plate cap protrudes down through the i.f-a.f.-power supply chassis to accept the plate lead of the first i.f. transformer. The power leads of this stage are combined with those of the oscillator stage.

The oscillator stage consists of a tuned plate-inductive coupled feedback circuit to provide uniform oscillator voltage over the tuning range. A polystyrene rod is inserted into the coil for mechanical support to keep the oscillator frequency stable and to provide a form for the feed-back winding. The plate tuned inductive feedback type of oscillator provides excellent stability and remarkable freedom from drift. Mounting the oscillator on the back plate of the shield between it and the mixer provides a sturdy base as well as compact construction which reduces the effects of troublesome mechanical vibration to a negligible degree and provides complete shielding, thereby reducing radiation to a minimum. In addition, the individual condenser shafts of the main tuning gang are electrically isolated from each other by flexible couplers to cut down radiation and circulating currents between stages which lower the coupling and resulting gain per stage or cause unwanted oscillation in the r.f. and mixer stages if permitted to become excessive. Each condenser shaft is grounded to the common ground point of its particular stage.

The coils of all three stages are self supporting air wound coils which may be replaced easily with homemade coils covering almost any equal range of frequencies between 50 mc. and possibly 200 mc. Keep in mind that the higher the frequency the more the troubles will multiply.

The main chassis contains the i.f. amplifier, detector, audio amplifier, and power supply. By an ingenious method of switching, operation of the receiver on either FM or AM signals is possible, using the same tube line-up.

The i.f. amplifier consists of two straightforward high gain stages operating at 4300 kc. and a third stage which operates as a low gain i.f. amplifier stage during AM reception and as a limiter stage during FM operation. During AM reception, this last stage operates with a series plate circuit decoupling resistor feeding normal amplifier voltage to the plate and screen, but when switched to FM reception the FM-AM switch connects a load resistor between the plate and screen connection and ground, dropping their potentials to a low value

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Fig. 1. Schematic diagram. Either of the two frequency ranges, 88.5 to 107.5 mc. or 115 to 140 mc., are obtained with a slight change in coil design.

so that the amplifier saturates at a predetermined i.f. signal level. A bypassed resistor is also switched into the grid circuit to provide additional grid saturation to the stage. The response of the i.f. transformers is sufficiently sharp for AM reception in the v.h.f. range, but still broad enough to provide true FM fidelity. This compromise is possible at the v.h.f. since the usual 10 to 20 kc. i.f. channels required for reception on the lower frequencies are too sharp for receivers at these frequencies.

The 6H6 following the 6SJ7 functions equally well as a detector for AM reception or as a discriminator for FM reception by switching the grid of the audio amplifier stage with the remaining section of the double pole—double throw FM-AM switch from the normal discriminator circuit for FM reception to the junction of the two discriminator load resistors (R_{10} and R_{11},) thereby obtaining the conventional diode detection required for AM reception without sacrificing performance.

A single 6C5 triode is used as the audio amplifier which provides ample volume for headset operation. Any high impedance headset, crystal or magnetic, will do the job. For high fidelity reception a good clean audio amplifier is required to bring the signal level up to two to thirty watts depending upon the owner's ideas on power requirements for high fidelity reception. Good all-around speaker volume may be obtained by replacing the 6C5 and audio choke (CH2) with a 6V6GT/G and output transformer to match the speaker, rewiring the receiver as shown in Fig. 2.

The addition of a heavy push-pull stage to the receiver proper is not recommended since the power transformer and filter system would be greatly overtaxed. However, the above modification will not cause trouble in this respect.

For the best results as far as FM reception is concerned, an inexpensive one or two stage power amplifier unit should be obtained, preferably one having a push-pull output stage employing tubes such as 6V6GT/G or 6L6. Several of these units, complete with power supply, have been on the market for some time in either working or kit form.

Regulated voltage for the oscillator and mixer stages is required for all v.h.f. receivers to obtain good stability. An OD3/VR-150 gas type regulator is used in this receiver for this reason. Adequate current is supplied for the unit by the 5Y3 full-wave rectifier working through a pi-section filter which provides hum free operation required by FM receivers for most effective results.

The testing and alignment procedure for the receiver is relatively simple. After completing the construction of the receiver, it is advisable to check the socket terminal voltages against the chart supplied with the kit before leaving the equipment turned on for an extended period of time. Checking these voltages will generally unearth any wiring errors which invariably creep into the job. Although a resistance chart is not supplied with the kit, an ohmmeter check is also desirable before turning on the equipment for the first time since this will very often save a rectifier tube.

When satisfied that the receiver is properly wired, connect a signal generator capable of providing a 4.3 mc., modulated signal to the grid of the 954 mixer tube. Set the FM-AM switch at AM and align the i.f. amplifier by the usual methods. If the individual stages are considerably out of alignment, it may be necessary to connect the signal generator to the grid of the 6SJ7 or second 6SK7 tube and align the following transformers, working back toward the mixer stage in this manner. Use an output meter for these adjustments as mere oral interpretation is not sufficient for accurate alignment. During alignment of the i.f. amplifier there should not be a trace of oscillation as noted by a swishing noise (or even worse, a whistle) as the trimmers are tuned through resonance. If oscillation occurs, recheck the grounds and shielding. Relocate ground wires if necessary. A good method for checking *hot* ground connections is to touch the grounded terminal with a metal screw driver, holding onto the shank of the tool, but avoiding contact with the receiver chassis when contacting high voltage points. If the terminal is hot, a loud click pours from the headset.

After aligning the i.f. amplifier for

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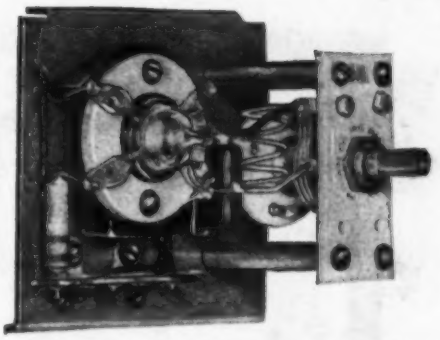
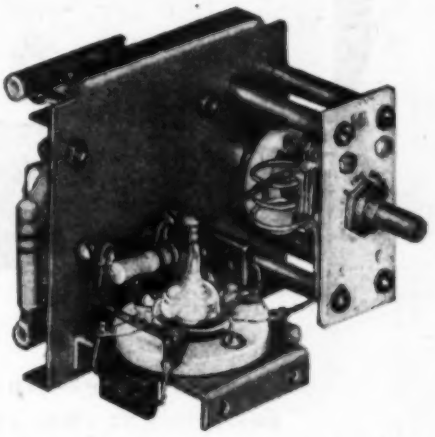
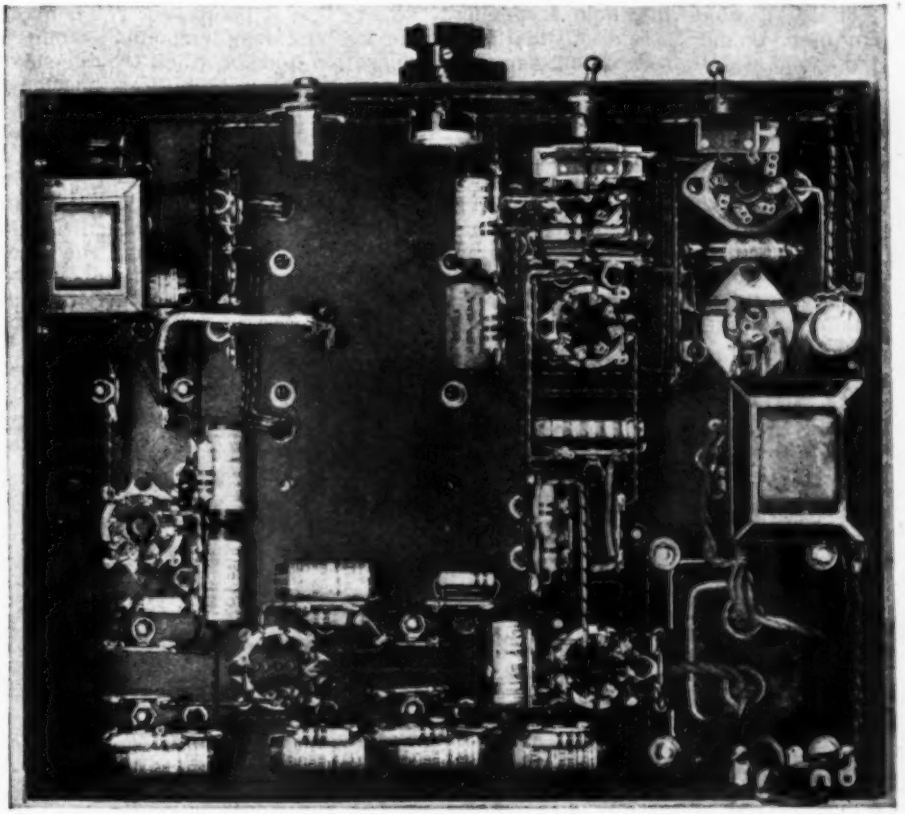


R.f. amplifier stage, employing a 956 acorn tube in a conventional tuned circuit with inductive coupling to the antenna and first detector stage.



First detector stage. For greater stability this stage, employing a 954 tube, is operated from the same voltage regulated supply as the oscillator.

Bottom view of the completed unit. Lack of excessive miscellaneous parts clearly indicates the simplicity of construction.



The AUDIO CHANALYST

By A. LIEBSCHER
RCA Victor Div., RCA

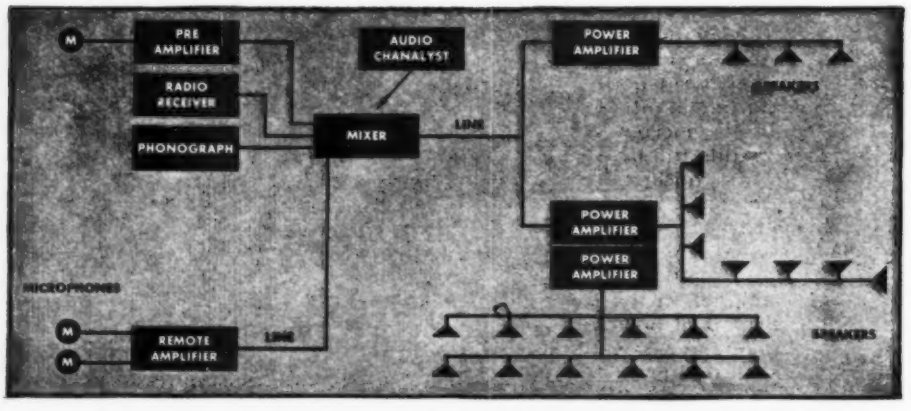
Fig. 1. Front view of the Audio Chanalyst—an instrument that is extremely applicable to diagnosing trouble in audio amplifiers, loudspeaker systems, and pick-up devices.

Complete description of a professionally designed and constructed instrument that can be used not only as a versatile servicing device for sound equipment but can also serve as an auxiliary amplifier.

AUDIO amplifying equipment, like radio, has grown up and now wears a neat, new, business-like appearance under the name of testing all kinds of audio frequency commercial sound. In industrial life, the sound system is becoming as much of a reliable cog in the wheels of routine operation as the telephone or typewriter.

In the past, the powerful little "five-watter" public address system needed little more than a voltmeter to keep it in operation, but today we see sound systems ranging from office communication and paging systems to complete factory installations with their own plant broadcasting studios, their feeder lines, switchboards, their racks of amplifiers capable of totaling 7500 watts of audio power and operating up to 3000 speakers, which cover 2,000,000 square feet of floor area. The demands for keeping complex sound systems in operation and for quick trouble-shooting of defective amplifiers, has led to the adoption of the same efficient testing principles in the diagnosis of audio trouble as are so successfully used in radio servicing (Fig. 2). Employing the same principles of signal tracing and providing complete facilities for sound equipment servicing, the Audio Chanalyst is a new and logical outgrowth of the well known *RCA* Radio Chanalyst.

Fig. 2. The Audio Chanalyst can be used to test all points in any sound system.



The *RCA* Audio Chanalyst is a trade name for a sound system channel analyzer, designed by *RCA* engineers.

Besides its basic use as a testing unit, the Audio Chanalyst (Fig. 1) can be used as an emergency replacement unit to bridge a defective section in any standard amplifier. It can also serve as an auxiliary amplifier for communications and entertainment when not in use as a servicing device. Motion picture sound, microphone, or phonograph pick-up can be reproduced by applying the Audio Chanalyst as a combined pre-amplifier, mixer, and power amplifier unit to produce audible output from its built-in loudspeaker or up to 1 watt from any auxiliary speaker.

The Audio Chanalyst is, in itself, a complete sound system test set, grouping a calibrated amplifier, a signal source, a vacuum tube voltmeter, and other testing and monitoring facilities, as one semi-portable equipment. It can be set up as a compact testbench in any convenient location to do a conclusive job of diagnosing trouble in audio amplifiers, loudspeaker systems, and pick-up devices.

The instrument itself consists of three principal sections or channels, a complete voltohmmeter, complete signal source, and a calibrated audio amplifier. To extend the facilities of this instrument, included are several additional devices such as an impedance measuring device, a distortion indicat-

ing device, a loudspeaker for audible testing, and a monitoring electronic indicator which can also serve as a trouble-shooting device.

Basically the Audio Chanalyst is designed upon the principles of *signal tracing,* with the necessary testing devices included in one unit, to support this procedure with utmost speed and convenience. Before the advent of this type of test equipment, it was necessary, in the case of faulty amplifiers, to check the values of the various condensers, resistors, transformers, and other components of the system to determine the cause of faulty operation.

Much time was formerly spent in measuring voltages, checking tubes, and substituting parts to determine the cause of an improperly amplified signal. With the signal tracing method, the signal is traced and checked *at the point where it enters* the amplifier, *at any point in* the amplifier, and *where it comes out* of the amplifier. Any change in quality or intensity is readily determined and the causes isolated to the components in the immediate vicinity in which the change in signal was first noticed.

If the intensity and quality of the input signal voltage is checked and measured to determine its *signal level,* and the output signal is likewise checked and measured, it is simple to see that a comparison of these two signal levels will indicate the working condition of the amplifier circuit (Fig. 4).

An audio frequency amplifier is thought of as a device built around an electronic vacuum tube. It is so constructed that when an a.f. voltage of low value is supplied to its input, a voltage at the same audio frequency but at a higher amplitude is available at its output, as in (A) and (B), Fig. 4. This device may be one tube where the signal is fed to its grid and the amplified signal made available at its plate. An amplifier system may be made up of a number of such stages hooked together in parallel or in series. These stages may be coupled together by means of condenser-resistor combinations or transformers. The circuits may work in a number of ways, push-pull, class-A, class-AB, etc., but the point to be remembered is that a signal voltage of one intensity is applied to the input of the circuit and a signal of greater intensity is made available at the output of the same circuit.

Normal gains and losses can easily be recognized in the course of signal tracing, especially when a speaker is used for audible monitoring. When doubt arises as to sufficient gain or improper attenuation, *gain measurements* can be employed with a calibrated amplifier as a standard of comparison.

From the foregoing it can be seen that the functions of the Audio Chanalyst are concentrated to achieve one net result through an organized testing procedure which involves the use of the signal as a common denominator. The signal, whether it be checked for its presence, its quality, or its intensity, is the subject of all primary observation. The amplifier channel of the Audio Chanalyst is designed to facilitate tests and, when necessary, measurements of the signal. The other channels serve to support these tests in furnishing signal source, indicating signal voltages and other functionally related voltages, revealing component values, and monitoring doubtful performance of electronic equipment.

Audio Chanalyst Applications

The purpose of the Audio Chanalyst is to provide means for checking and testing all kinds of audio frequency amplifying systems, including a.f. amplifiers of all types, complete sound installations, sound-motion-picture equipment, broadcast speech input equipment, telephone and intercommunication systems, a.f. components—microphones and phono pickups, phototubes, speakers, etc.

A little study of the possible defects which might arise and, oddly enough, have common relationships in the various devices listed, makes it possible to establish four principal categories as the first step toward isolation of those defects—failure to operate, weak or low output, poor quality, and interrupted operation.

One can, of course, identify these by ear, but the final and definite analysis of any defect may become quite a vexing problem. A rapid analysis of the problem at hand should help to determine the need for equipment, if any, and the extent to which it is to be used. It is wise, therefore, to be prepared with a general knowledge of the functions and applications of instruments such as the Audio Chanalyst, so that one's ability will include a familiarity with systematic methods of coping with more difficult problems when they present themselves.

It is with this thought in mind that the following descriptive explanation is presented with reference to the subdivisions of the Audio Chanalyst channels.

The amplifier channel of the Audio Chanalyst consists of a four-stage calibrated amplifier. Each stage may be used separately or the four stages may be cascaded and used together as a high-gain amplifier with an undistorted output of 1 watt.

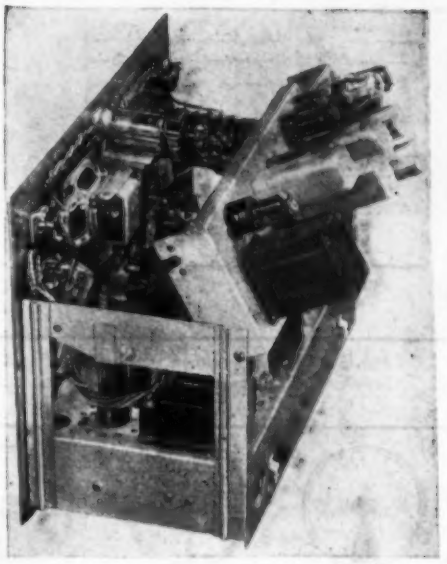


Fig. 3. Side view with cover removed.

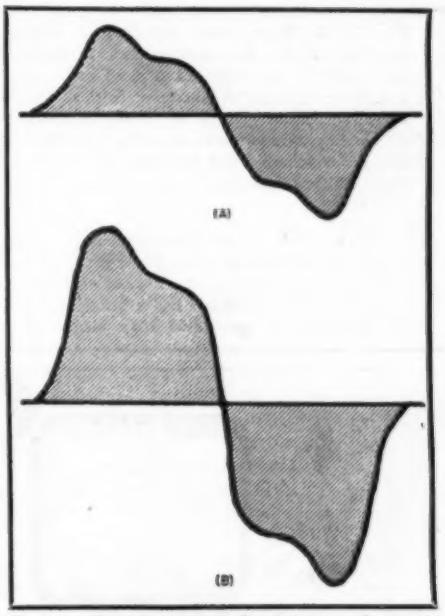
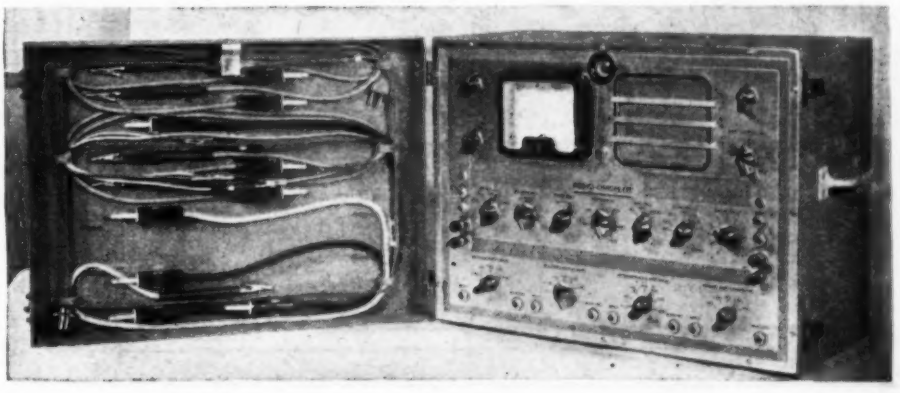


Fig. 4. By comparing the input and output signals, the working conditions of an amplifier circuit can easily be determined.

The first stage is identified as *voltage amplifier-1* and has a jack input through a calibrated five-step attenuator. The output is capacity-coupled

Fig. 5. Front view with front cover open, showing location of cords, cables, plugs, etc.



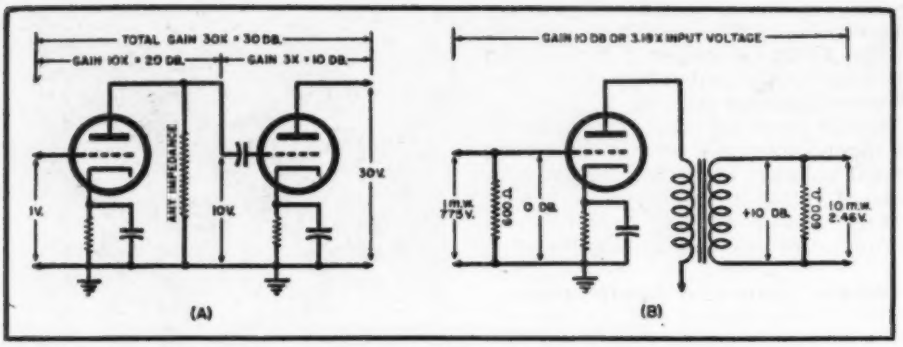


Fig. 6. (A) Db. voltage ratio gain checking without reference to any given zero level. (B) Db. power gain measurement. Zero is equal to 1 mw. across 600 ohms.

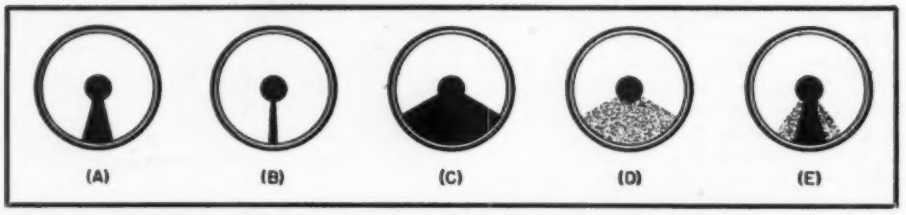
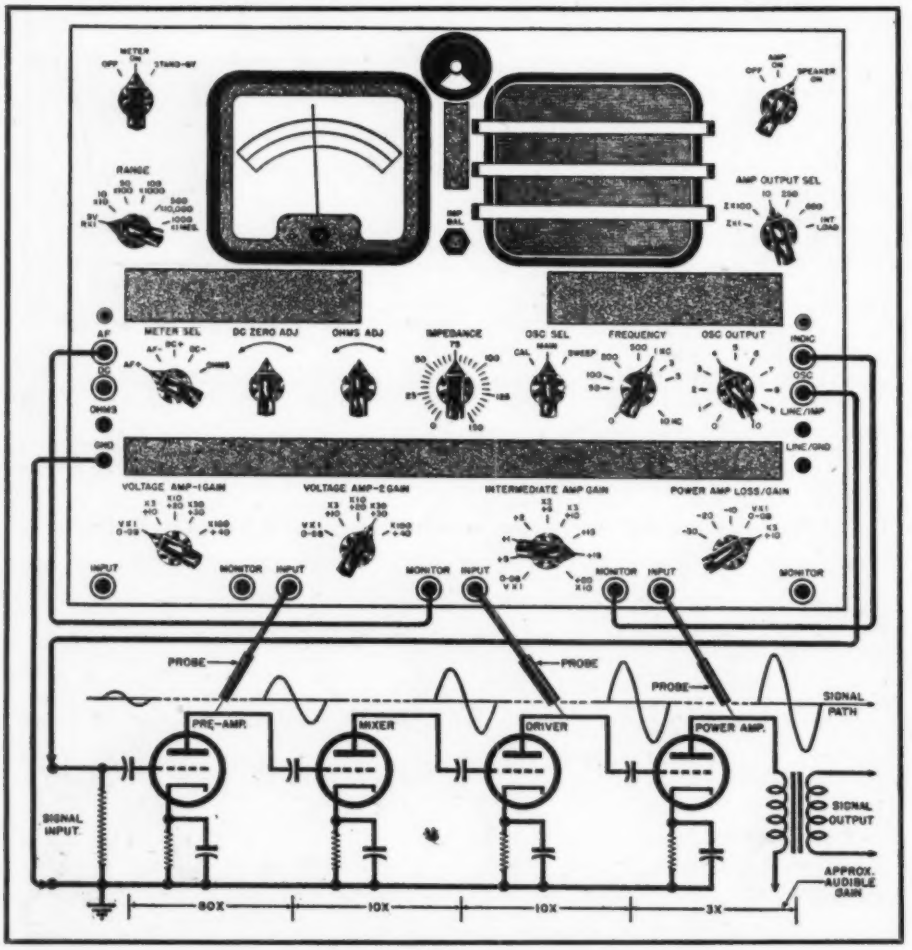


Fig. 7. Shadow angles for various voltage conditions. (A) Normal adjustment of indicator. If no d.c., a.c., or a.f. is present, the shadow angle will not change. It will register as low as a half-volt. (B) Negative d.c. is indicated by partial or complete closing of shadow angle. (C) Positive d.c. causes increased opening of shadow angle. Time to return to normal shows relative amount d.c. (D) A.c. or a.f. will produce deflection in positive and negative directions and can be identified by medium light intensity over the deflection area. (E) Flickering in two directions shows irregular a.f. peaks; in one direction, interrupted or pulsating d.c.

Fig. 8. The Audio Chanalyst may be used for monitoring purposes. It is important to remember that the gain and osc. output controls should be adjusted so that any change in the signal voltage output of any stage of the amplifier under test will be indicated by a fluctuation of the indicating devices. Care should be taken not to overload any stage of the amplifier or the amplifier channel.



to the second stage and is accessible through a jack marked *monitor*. The output of the first stage may be taken off at this jack without interfering with the coupling to the second stage. However, there is another jack connected to the input of the second stage; when this jack is used, the first stage is cut off from the second, which may then be used independently.

Through this simple double jack arrangement, the four amplifier sections may be used as four separate amplifiers, each with a calibrated input attenuator; or when the first input is used alone, the entire channel functions as a complete amplifier. Input and output connections are supplied for each stage as well as additional transformer output coupling for the last stage.

The second stage, *voltage amplifier-2*, is identical with *voltage amplifier-1*.

The third stage is termed *intermediate amp.* and has a continuously variable attenuator input with a voltage and decibel gain calibration of one-half that of the first or second stage.

The last, or power output, stage is marked *power amplifier* and has a calibrated five-step attenuator in its input which allows the input signal voltage to be attenuated to -30 db. or amplified to a gain of 10 db.

The design of the amplifier section is based on the volume unit system using a zero level of 1 milliwatt across 600 ohms. Its maximum power gain is 110 db. Individual calibration controls for each stage are accessible through openings in the bottom of the case and the voltmeter section can be employed as a standard of gain calibration in making adjustments. The input to any particular stage in the amplifier channel leads to its grid and this makes it possible to trace a signal with high input impedance and with a choice of input levels. When it is desired, however, to have a typical line input impedance for microphone matching, a 250-ohm center-tapped, plug-in input transformer can be used with any stage having sufficient gain for that service. It can be obtained as an accessory shown in Fig. 9.

The Audio Chanalyst amplifier is calibrated in both decibels and voltage multiples, providing for the use of either system of gain measurement. Gain can be checked in any amplifier regardless of its zero level, by merely determining the amount of gain required by the Chanalyst to equal that of the amplifier in question. In such a case, the initially applied a.f. voltage can be checked in terms of its multiples. If it is desired to use a basic zero level, it will be found that this instrument, with its meter and amplifier channel calibrated to the volume unit system, lends itself well to such application.

The amplifier can be adjusted to match various load impedances by means of an output selector switch, which provides 500-ohm, 250-ohm and

(*Continued on page* 92)

With JOE MARTY

Associate Editor, RADIO NEWS

AS THIS is being written, most of the regulations controlling the radio industry have been cancelled, or are on the verge of being so.

This means that in the not-too-distant future, much new merchandise will be available for sale. As this merchandise is channeled into the consumer's home, there will be a gradual slackening off of repair work. One thing you can be sure of is that the honeymoon, as far as large amounts of service work at good prices is concerned, is over. The serviceman must make the decision at once that he will improve his merchandising techniques if he intends to stay and prosper in this business. To improve his merchandising picture, he must tighten up his whole operation with regard to sales.

First, a determined effort should be made to clean up the premises. Most service shops that I have visited in the last few months certainly could collect no medals for neatness; in fact, most of them were slovenly to the point of being disgusting. The store part of the establishment was little better. The serviceman might just as well learn now that the public will not tolerate such conditions. In this postwar world, the emphasis is being placed on new store fronts, new and clean merchandising displays, and aggressive sales promotion. Do not imagine that because you have been able to make money during the war by operating in a high-and-mighty manner, you can continue to do so. Too many servicemen have taken advantage of the situation during the period of shortages just passed, to the point that all servicemen are on trial with the public. Most of you remember that you were not in any too good a position before the war. About all that has improved during the war period is your financial position. For the first time, many of you are in a position to improve your shops without having to go in debt to do it. The time to do it is now, if you are going to be in a position to compete with newcomers in the field. Make no mistake about the type of competition you are going to have: it will be the best. Many smart merchandisers from all fields are ready to move in on the electronics industry and they are going to use every technique they know to get and hold business.

Efforts should be made at once to re-establish customer contacts that have been lost during the past few years. Old customer and repair lists should be combed for all the *live* names. These people should be contacted by phone, by mail, or in person, in order that they may know that you are still alive and are doing business at the old stand. Be businesslike about these surveys and operate your business as a business, not as a hobby. It might be nice to play around with it, but it doesn't pay off. If you feel that your own time is too taken up to make these customer contacts, hire a girl, part or full time, to do it for you.

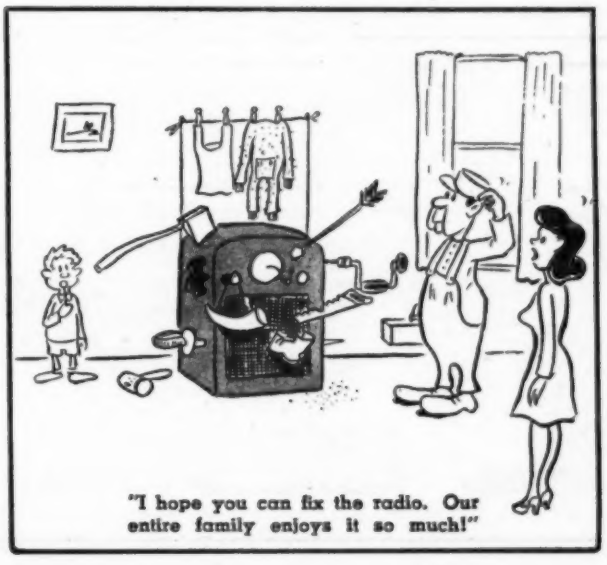
Now is the time to refurbish the service shop itself. Almost every shop needs new test equipment. See your jobber and get squared away on the job of bringing your shop up-to-date. Now, more than ever, you are going to have to do service work faster and more efficiently, if you are going to make money. Miscellaneous items such as hand tools, soldering irons, patchcords, test prods, etc., should all be gone over and put in shape or replaced.

In the purchase of new test equipment of all kinds, remember that you will require new types of equipment in order to handle such things as FM and television, as well as industrial equipment. Be sure that the signal generator that you are planning to buy will cover the new frequencies and that the tube tester will take the new tubes. Great care should be exercised in the purchase of surplus government test equipment to be sure that it is in operating condition, not obsolete or likely to be obsolete in a short time. Here again, the best advice is to see your local jobber or supplier.

A few words here about the training needed to operate this new equipment will not be amiss. Remember that you will be getting into a field in which you have had relatively little experience and you should prepare yourself by diligent study to master it. Operation in the higher frequencies is more critical than in other parts of the band and tolerances are closer. All this precision work requires a higher degree of skill and knowledge than heretofore.

New installation problems will have to be faced. No longer is it possible to throw a piece of wire on the floor and expect good reception. This problem will grow more acute as the number of FM and television sets increase. Your installation operation should include service to the dealer as well as to the individual. Be sure you are equipped for this work. This includes ladders, measuring equipment, trained personnel, etc.

In fact, it begins to look as though a showdown fight between the independent serviceman and the service shop, that is an integral part of a retail dealer's setup, is beginning. The insistence by the manufacturers that individual retail dealers maintain their own service shops is on the increase. This means that the independent serviceman will be forced to compete with the dealer serviceman for the existing retail service business. No doubt the installation problems of television and FM as envisioned by the manufacturers has a great deal to do with this decision on their part. This should serve as a warning to those of you who are operating as independent servicemen to put your houses in order and to prepare for the forthcoming battle. Contracts that you have with dealers now should be overhauled and new contracts written so that you are in a competitive position as soon as possible.

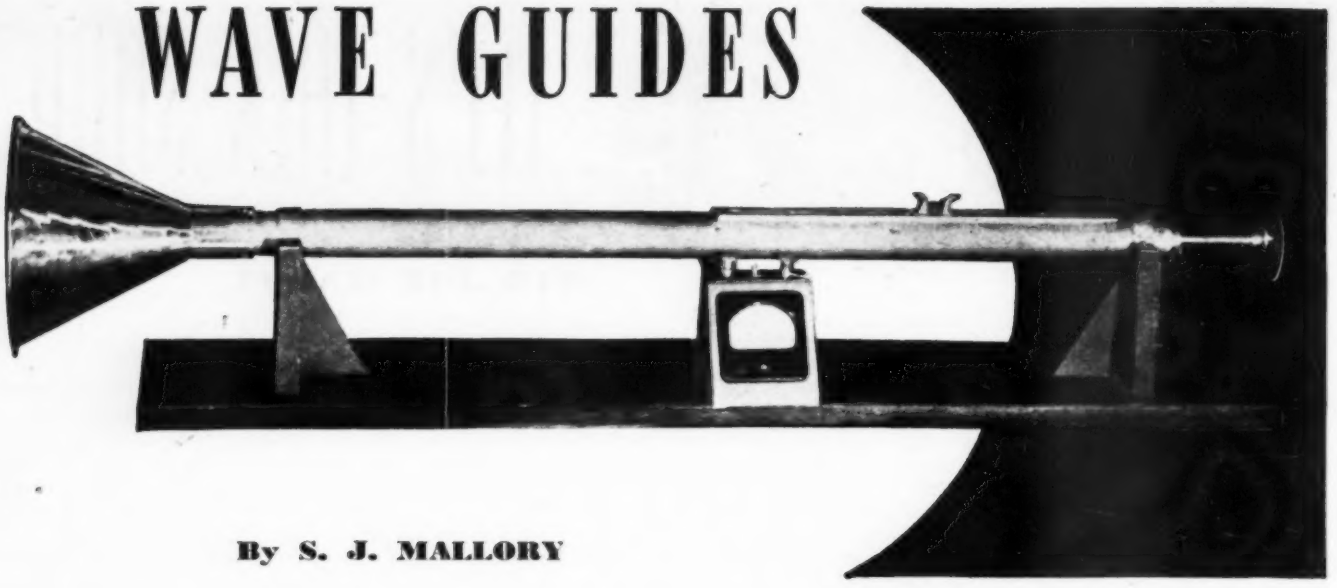


"I hope you can fix the radio. Our entire family enjoys it so much!"

Your operation must become streamlined if you are to survive.

The future looks bright, but as usual, it will take a smart merchandising-minded serviceman to make it pay off. —30—

WAVE GUIDES



Experimental set-up of a circular wave guide terminating in a horn radiator.

By S. J. MALLORY

Non-technical discussion of advantages and possibilities of wave guides for piping television programs.

A WELL recognized major problem confronting television engineers is that of providing links between cities for television network broadcasting. In the case of radio, network programs are sent over ordinary telephone lines to the many community radio stations. Television pictures, however, cannot be transmitted over existing lines.

A limited solution to this problem is a network of coaxial cables similar to those in use by the Bell System to provide telephone circuits between New York and Philadelphia and between Minneapolis and Stevens Point. These cables, however, have a capacity of only one television channel each. Shortly before the war, engineers found that by eliminating the center conductor of a coaxial cable it could carry much higher radio frequencies with remarkably little loss. Using these high frequencies, the number of available radio and television channels increases accordingly.

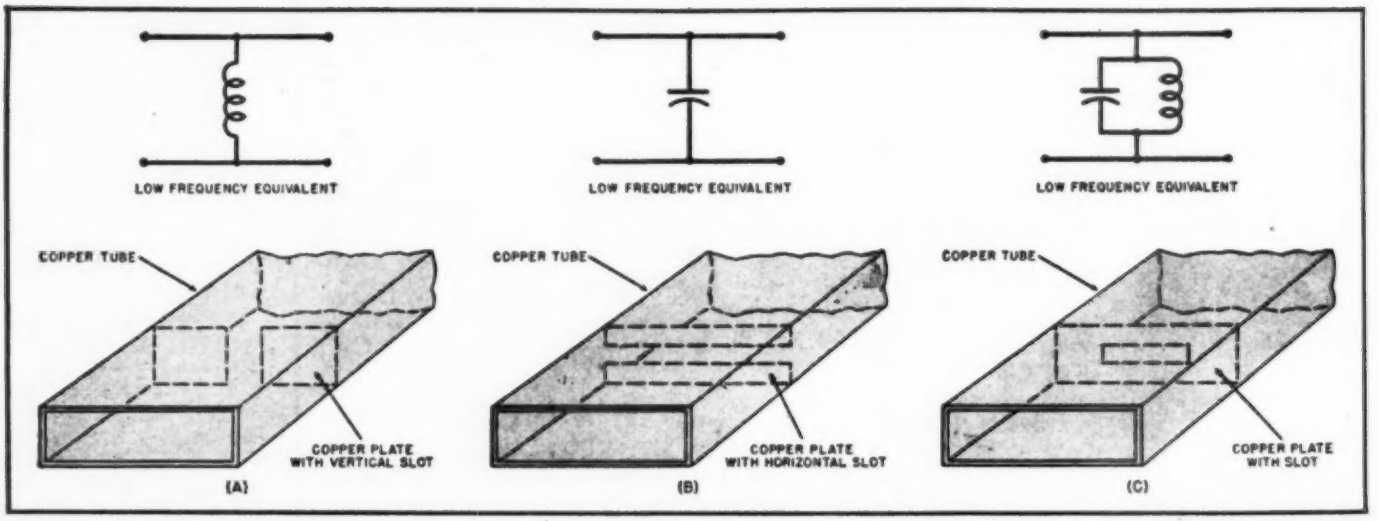
This new hollow transmission line is known as a wave guide. It may be of circular, square, rectangular, or other cross-section. Early work was carried on with the use of circular wave guides. Later, rectangular guides were found to have advantages for some purposes.

A single half-inch diameter wave guide could carry every television program in the country if need be. These wave-guide transmission lines between cities could carry television over the mountains and under the rivers to all the peoples of the United States as they are now served by ordinary network radio programs.

Within the city, wave guides could serve as a reliable medium through which television would reach additional thousands. Theaters could have a wave-guide connection with the main distributing system and the audience could see the news as it happens. Apartment dwellers could have the television piped in like water and their receiver could select any of several picture entertainments without concern of high buildings between the desired station and their cozy living rooms. Newspaper photographers could sit in their office studios and select their news shots from any of the half dozen news service television pictures "piped" from the scenes of the actual happening. All this over the small pipe we call a wave guide.

All this and more was made possible when two American engineers working independently announced al-

Fig. 1. Well-known low-frequency circuit elements can be simulated by placing a slotted metal plate across the inside of a wave guide. (A) With a slit across the short side, an inductive effect is obtained. (B) A capacitive effect may be had by placing the slit across the long side. (C) By employing a slotted plate, the wave-guide iris represents a shunt resonant circuit.



most simultaneously the discovery that radio waves of frequencies thousands of times as high as those used for regular broadcast purposes could be transmitted through pipes or tubes even when filled with an insulating material. Pipes when used for this purpose are known as wave guides.

Why not use an ordinary pair of parallel wires to transmit these high-frequency signals? Ordinary two wire lines are suitable for use at low frequencies, but at ultra-high frequencies the capacity between the conductors gives too great an attenuation and, furthermore, the waves would radiate from the wires and be lost in space.

Coaxial cables which are in common use are in reality merely a form of parallel wires with the difference that one conductor is tubular and wholly encloses the second conductor. The inner conductor is supported on small insulators and is concentric with the outer conductor. This construction prevents loss of high-frequency energy by radiation but does not overcome the capacitive losses.

The transmission of electric waves through a hollow pipe is contrary to our ordinary conception of conveying electricity in that no return conductor is provided. However, these waves may be compared to the radio waves which are sent out from an ordinary radio transmitting antenna. In actual practice the waves to be sent through a wave guide are launched from a small antenna placed a quarter wavelength from the end of the wave guide. The transmitting ground is the wave guide proper.

Electromagnetic waves of a wavelength greater than about twice the diameter of a round wave guide will not flow through the guide. This wavelength is known as the cut-off point. The frequency corresponding to this wavelength is known as f_c, the cut-off frequency, or the critical frequency. All higher frequencies or shorter wavelengths can be transmitted through the wave guide. The critical frequency of a wave guide of rectangular cross section is determined by the larger of the two cross-sectional dimensions. The small dimension determines the amount of power the wave guide will handle. A ¼" x 2" wave guide will transmit a 5 cm. wave of a fair amount of power.

Various appliances and fixtures have been developed for use with wave guides. These fixtures or plumbing, as they are often referred to, are analogous to familiar circuit components used in low frequency radio or electrical circuits.

A thin metal plate mounted across the inside of a wave guide may be cut or altered to simulate well known low frequency circuit elements. A slit cut across center of the plate parallel to the short side and leaving a small window will react as an inductance (Fig. 1A). A similar opening made parallel to the long side acts as a capacitive

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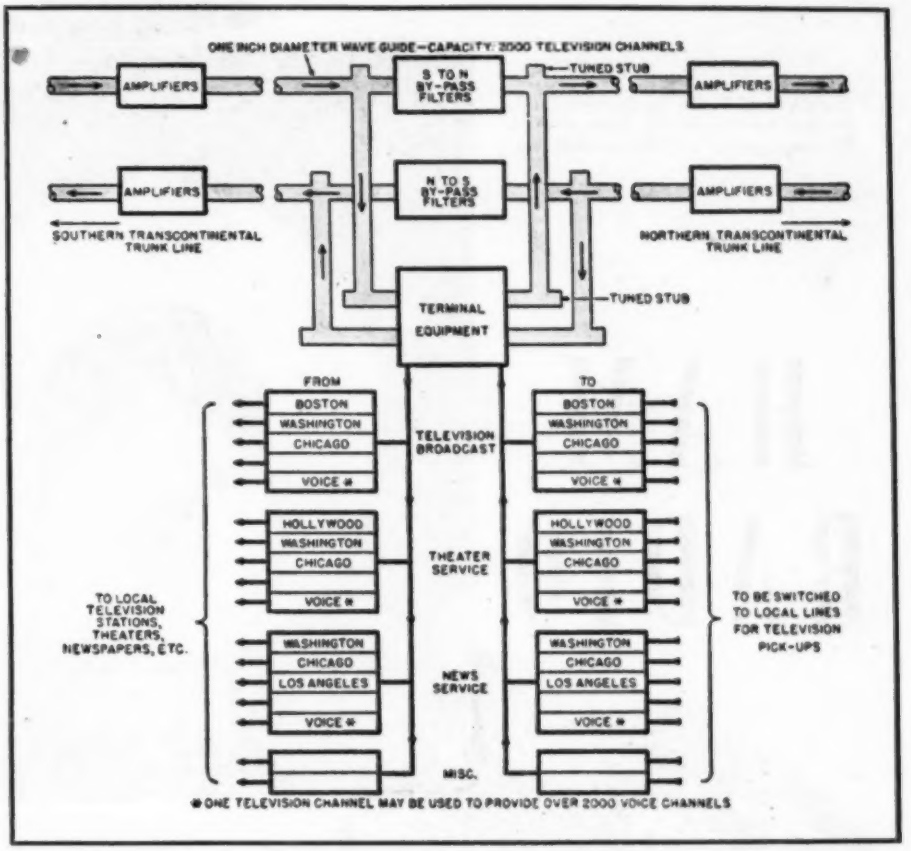


A typical television distribution terminal for a wave-guide transmission line.

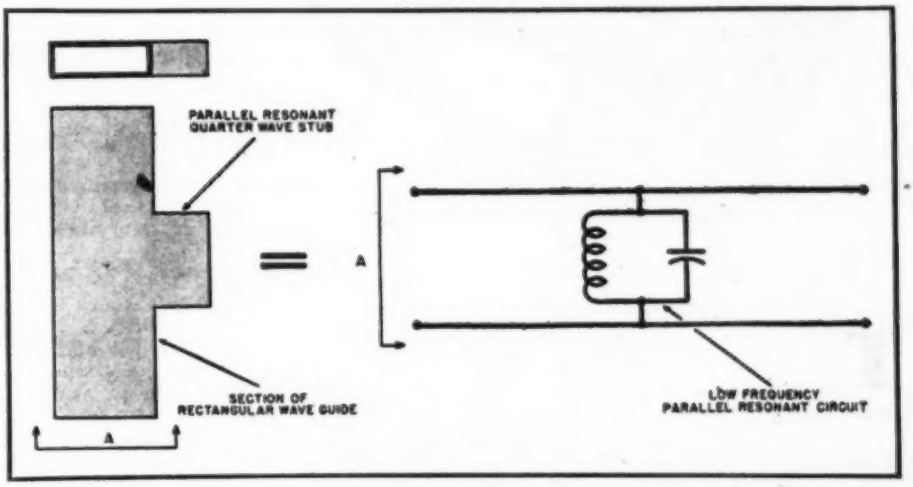
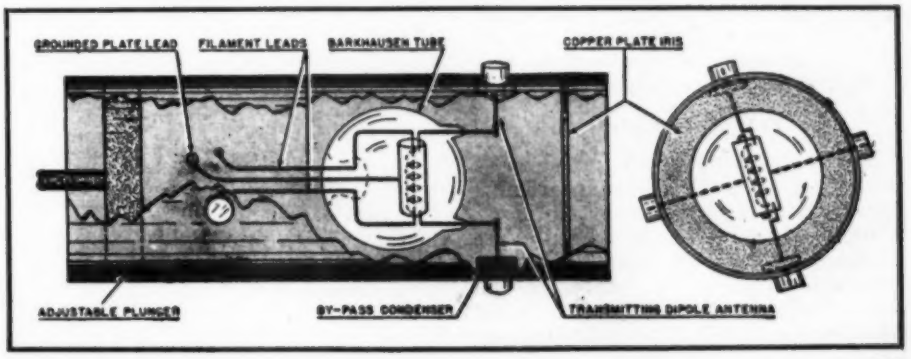
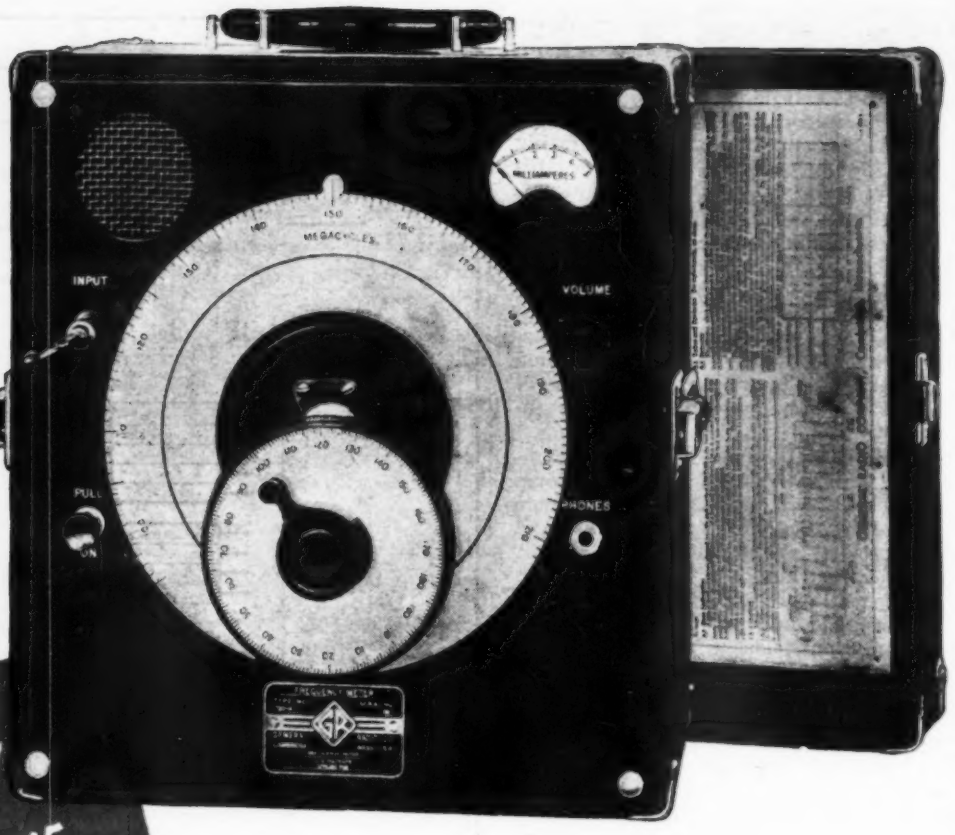


Fig. 2. A section of wave guide one-quarter wavelength long, connected to the side of a wave-guide transmission line, is equivalent to connecting a parallel resonant circuit across a low-frequency two-wire line.

Fig. 3. A Barkhausen-type oscillator mounted in a resonant cavity is suitable for generating electric waves to travel through a circular wave guide.





The General Radio Company's 720A-heterodyne frequency meter, range 30 megacycles to 3000 megacycles.

HAM RADIO

Today and Tomorrow

By
"REG" WASHBURNE (ex-2AUS)
and
"ARCHIE" WILLIAMS (W8ODX)

The veil of secrecy is being lifted from many wartime developments. The authors present a preview of parts and equipment to be used for a new era of ham radio.

THE marshalling in of global peace signaled the freeing of international amateur radio from considerable governmental control, as witness our own temporary reopening of the *112 mc.* band recently. To what extent will the amateur be prepared to resume his rightful position socially and technically among front-rank radio men? What frequencies should he plan to use? Will components and apparatus suitable for use on these frequencies differ greatly from prewar types? These and many other questions will plague the radio man; some of the answers here presented may make interesting reading.

The Ham Spirit

According to *Webster's*, an *amateur* is a person who cultivates a particular pursuit, study, or science, from taste, without pursuing it professionally. In *Cockney English*, when applied to the non-professional experimenter in the art of radio communication, the word became *h'amateur*. This colloquialism evolved into the affectionate diminutive *ham*, a term which has found international recognition (even as have the *Wouff Hong* and the *Rettysnitch*, about which the hoary ham will tell you many a tale). Now that the first flush of peace is over, hundreds of thousands of men will gravitate into amateur radio. Many will be *old timers* in the *ham game*—fellows who learned their radio from *A* to *Z* the hard way—having assembled their station from home-made equipment. Others will be newcomers who learned radio while in the service.

It will be the duty and privilege of the former to inculcate in the latter the *ham spirit*—that *esprit de corps* peculiar to amateur radio which before the war had welded hundreds of thousands of enthusiasts into a powerful, non-commercial group exemplifying world-wide good neighbor fellowship; while approximately 60,000 in America had been licensed to transmit, many others were content only to listen and experiment. Just for the record, we wish to call attention to the cornerstone around which postwar ham radio must rally. Its tenets

Fig. 1. A comparison of the old and new amateur radio bands.

AMATEUR WAVEBANDS

PRE-WAR		POST-WAR	
METERS	MEGACYCLES	METERS	MEGACYCLES
160	1.75–2.05	160	(2)
80	3.5–4.0	80	3.5–4.0
40	7.0–7.3	40	7.0–7.3
20	14.0–14.4	20	14.0–14.4
10	28.0–30.0	(3) 15	21.0–21.5
5	56–60	10	28.0–29.7
2½	112–116	5	50–54
1¼	224–230	2	144–148
1	(1) 300+	1¼	220–225
¾	400–401		420–450
			(4) C.R.S.
			1145–1245
			2300–2450
			5250–5650
			10,000–10,500
			21,000–22,000

(1) AMATEUR OPERATION PERMITTED ON ANY FREQUENCY ABOVE 300 MEGACYCLES WITH A SPECIFIC ALLOCATION OF 400 TO 401 MEGACYCLES.

(2) SLIGHT POSSIBILITY OF AMATEUR "DISASTER" BAND SOMEWHERE BETWEEN 1605–1800 MEGACYCLES.

(3) TENTATIVE FREQUENCIES FOR AMATEURS BELOW 25 MEGACYCLES ARE SUBJECT TO INTERNATIONAL AGREEMENT.

(4) 460–470 MEGACYCLES ASSIGNED TO "CITIZENS RADIO SERVICE."

should be closely akin to those salient points set forth in the Amateur's Code.

"The Amateur is Gentlemanly.—He never knowingly uses the air for his own amusement in such way as to lessen the pleasure of others.

"The Amateur is Progressive.—He keeps his station abreast of science. It is built well and efficiently. His operating practice is clean and regular.

"The Amateur is Friendly.—Slow and patient sending when requested, friendly advice and counsel to the beginner, kindly assistance and cooperation for the broadcast listener; these are marks of the Amateur Spirit.

"The Amateur is Balanced.—Radio is his hobby. He never allows it to interfere with any of the duties he owes to his home, his job, his school, or his community.

"The Amateur is Patriotic.—His knowledge and his station are always ready for the service of his country and community."

With foreign amateurs returning to the air, American hams will have the opportunity of renewing and consolidating the fellowship spirit by exchanging ideas, and of conducting experiments to further the knowledge gained throughout the world during the war years. In this way many specialized wartime developments may be explored with a view to developing peacetime applications.

A great number of young men from all walks of life have found a permanent interest in radio as a result of our Government's schooling in communication and radar installation, operation, maintenance, and repair. (Say fellows, is there any truth to the story that the Signal Corps detailed all the ham trainees to mess-hall duty, and checked all the ex-short-order-cooks into the 10 w.p.m. class preparatory to making them communications men? Hi!)

It should be the duty of governments to provide room in the frequency spectrum for these trained men to carry on their interest in radio as a hobby, thereby adding to the backlog of skilled technicians and operators who will be available in emergencies; equally, it should be the duty of recognized organizations to do everything in their power to acquaint these radio enthusiasts with the benefits and purposes of ham cooperation toward furthering the art. The amateur interested in entering *the game* after being released from the services, should lose no time in taking out station and operator's licenses, and in joining a local radio club having national affiliation. This will enable him to take full advantage of the facility in traffic handling, the technical experience, etc., he gained while in the service; and, where Uncle Sam insists on a basic knowledge of the telegraphic code as a prerequisite to granting a license, men who have been in the service will possess an advantage. (How about it! Can you still handle at least 13 w.p.m.?)

Frequency Allocations

Before we can discuss the design and use of postwar components and equipment we must have some idea of the frequencies on which operation will be permitted.

According to information released by the Federal Communications Commission, ham bands eventually will include those shown in Table I. A prewar, postwar comparison of amateur radio frequencies is visualized in Fig. I.

The figures, when presented in this manner, show that there are approximately 440,000 channels in the proposed *ham paradise* to date; by selection of proper transmitter power and receiver sensitivity, and the use of directive antennas, it should be possible to set up an additional nearly half-million stations for any horizon area!

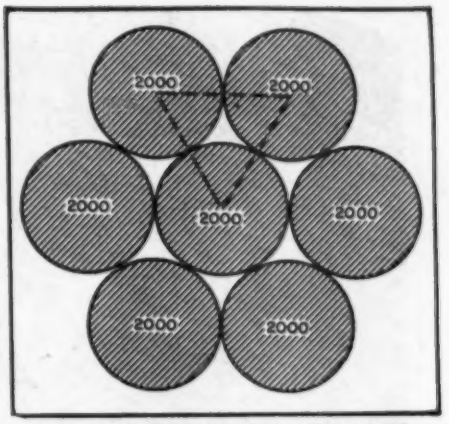
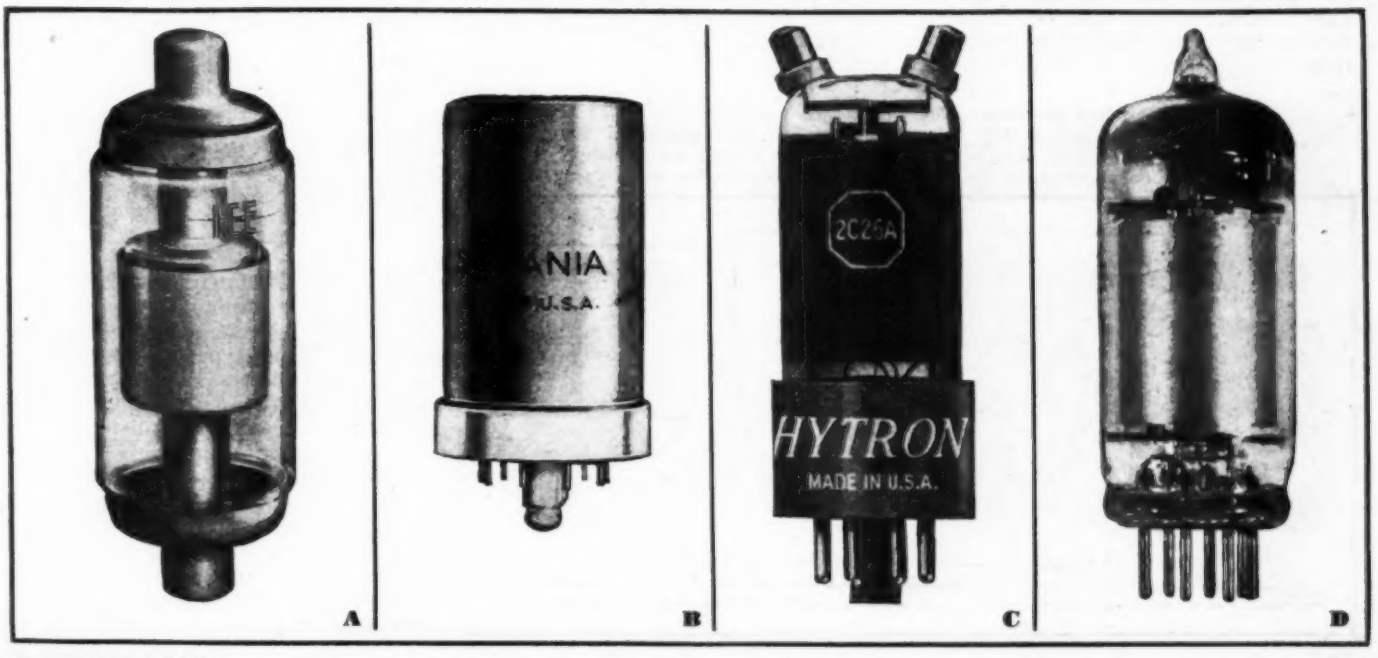


Fig. 2. In the C.R.S. range 460 to 470 mc., which provided for 2000 channels each 5 kc. wide, additional stations may be operated in areas (shaded) at double the line-of-sight distance (dotted).

The commission threw a bombshell when, last winter, it announced the creation of a free-for-all Citizen's Radio Service, and allocated to this service the frequency range 460 to 470 megacycles (2000 channels, if each is considered as 5 kc. wide; and here again, another approximately 12,000 stations may be operated, without interference, at double the line-of-sight distance, as shown in Fig. 2). It is the understanding of the writers that virtually no restrictions will be imposed upon the users of equipment designed for this band and that the equipment may be adjusted to any desired degree within the limits of its design. Just

(A) Vacuum capacitors, such as that shown, are unaffected by climatic conditions. Capacitors of this type may be had in values ranging between 6 and 100 micromicrofarads. (B) This EF50 is a modified British VR91 tube and has been employed in 284 types of radar equipment. (C) This 2C26A triode will deliver 2 kw. of useful r.f. pulse power at 200 mc. (D) The over-all length of this direct heater 2B25 rectifier tube is 2¼ inches, yet it delivers 1.5 ma. at 1000 volts. The filament draws 110 ma. at 1.4 volts.



Panoramic reception shows what stations are on the air, whether phone or c.w., and their signal strengths. An instrument of this type will help keep airlanes clear by reducing CQ calls to a minimum. Hallicrafters model S-35 is shown.

how all this will affect the radio amateur is not yet clear; almost certainly, however, he will want to try his hand at making and using a *walkie-talkie* or a *handie-talkie* (as the more portable type is called) and perhaps combine it with a key for telegraphic communication under conditions unsuitable for voice transmission. (At the close of peace, hams were just warming up to the idea of mobile units for car-to-car contact and so the C.R.S. may quickly fit in here.)

Table I shows the amateur frequencies that have been announced by the FCC. Those below 28 mc. are tentative and subject to ratification by International agreement.

Licensed ham operation at ultra-high frequencies will impose upon the amateur the obligation of maintaining frequency, in the band, within limits beyond anything he has heretofore experienced. Such factors as rigid mountings, proper soldering, choice of insulating materials, and placement of parts, all will loom large. Until commercial test equipment becomes available at *amateur* prices, the ham may be compelled to improvise his own apparatus for checking frequency and modulation, for monitoring, etc.

In this connection, the mushroom growth of amateur radio after its forced inactivity (except in the War Emergency Radio Service—WERS, and the Army and Navy *nets)*, will probably see extension of the standard transmissions of station WWV into at least some of the amateur frequencies, or related harmonics. Transmissions at present are on 2.5, 5, 10 and 15 mc., and include accurate, standard time intervals, and standard audio frequencies, including 440 cycles (musical pitch).

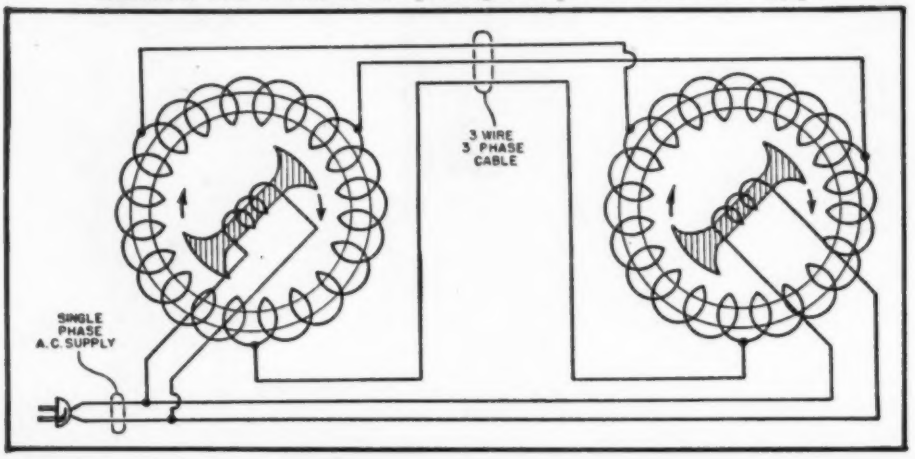
We now present some of the highlights in component and equipment design which may influence amateur radio construction and operation in the near future.

Tropicalization, or fungus-proofing.—Hams planning *safaris* into sections of country having high humidity may find it necessary to protect equipment against the ill effects of such climate. In any event, there is little objection to having our equipment so protected; it is quite desirable in v.h.f. apparatus. Tropicalization now may be accomplished through the use of a number of protective coating materials, all of which were originated or perfected during the war. These include phenyl mercury, pentachlorophenol, and salicylanilide. These coatings may be applied by spraying, dipping or brushing, followed in some cases by baking, depending upon whether the fungicide is to be applied to phenolics, hookup wire, textile-covered cords and cables, waxes, etc.

Q-Max, Dulac, 912, and other brands of protective coatings combine the characteristics of an anti-fungus chemical and a lacquer; they were used prewar as the latter. Many are satisfactory for use as coil insulation at high frequencies, usually improving the Q factor.

Hermetic seals are an important contribution to the protection, in an entirely different manner and for other reasons, of condensers, transformers and other components against the ill effects of atmospheric conditions. Sperti, Stupakoff, and others, make glass-to-metal and ceramic-to-metal seals, or beads, which are obtainable separately and later integrated into the finished product, to serve as mountings and connections. Most of these seals employ kovar, a cobalt-nickel-iron alloy. Through a heating process it forms a chemical bond with hard glass, the kovar-oxide dissolving into the glass, which has the same coefficient of expansion.

Fig. 3. Theoretical diagram of the selsyn-type transducer, in which the armature of one unit exactly follows the rotating field generated upon turning a second and remote armature to which it may be electrically connected, both armatures being energized by a common a.c. supply.



Components

Antennas.—The remote rotation of rotary beam antennas may be facilitated through the use of selsyn-type *motors.* This type of apparatus is variously known as selsyn (Q.E.), synchro (Ford Instrument), autosyn (Bendix), telegon (Kollsman), etc. One such mechanism, the Elinco drag-cup induction generator, has been produced in quantities perhaps large enough to bring the peacetime cost of this type of remote-control mechanism within the reach of the amateurs' pocketbooks. As illustrated in Fig. 3, this device requires only a 115-v., 60-

cycle supply, common to the local and remote units, for proper operation. In this type of equipment, turning one rotor causes the unit to act as a generator, the resulting voltage causing the remote unit to act as a motor, and its rotor to turn in exact unison.

Where the continuously variable type of control afforded by selsyns (with 3-wire cable and a.c. supply) is not necessary, the less expensive step-type control may prove satisfactory. One such unit is the Price 8210 automatic stepping selector (with 13-wire cable and d.c. supply). It consists of a ratchet motor and repeater switch, a 12-point, 4-gang wafer switch, and a terminal board.

A rotary beam antenna and remote position indicator have been announced by Gordon Specialties. The rotating platform will support a four-element, ½ wave antenna array for 12 mc. operation and up. A *selsyn* rotates the antenna. A remote indicator, operated by a second selsyn, shows antenna position.

Light, strong, plywood masts, announced by Plywood Corporation may be erected to 55 feet height by one man.

For portable work, neoprene balloons approximately four feet in diameter soon may be available. The inflating gas is preferably helium. Box kites may be made generally available by a West Coast company. A thin phosphor-bronze antenna wire, light and strong, suitable for use with either of these *elevators* was developed during the war by an Indiana concern.

Cables.—High-frequency cables have been improved, notably through the substitution of buna-S and neoprene synthetic rubbers for natural rubber. Thermoplastic insulations also have been developed to high degree, and include Polyvinyl Ankoseal and Polyethylene Ankoseal; the latter is recommended for its low dielectric loss in high-frequency transmission.

Coaxial cable has undergone considerable improvement in the war years. Among 29 types now found in the Intelin line of Federal are the following groups of lines (Army/Navy R.F. Cable Coordinating Committee designations): coaxial, solid dielectric, semi-flexible; coaxial, air-spaced, low capacitance; coaxial, attenuating, coaxial, high-impedance, spiral delay; dual (balanced); and dual-coaxial, highly-balanced.

Tubes.—Transmitter tubes of many types will be plentiful, now that peace has been declared. One manufacturer, for example, with only about 8 or 10 types in his prewar transmitter tube line, now promises to make over 20 improved types available for ham use. Receiver tubes will be much more abundant as to types.

RCA alone has built 200 *new* electron tubes and 350 different types of apparatus never made before, according to Gilbert Seldes' "The Future of Television," in a recent issue of *Esquire*.

The G. E. Lighthouse—a radical departure in tube design and known also as the *disc-seal* tube—promises to make workable many of the higher frequencies shown in Table I. It is particularly suitable for use at the very-high frequencies. Even now, military security precludes telling its whole story. Briefly, the tube is an assembly of anode and grid resonators, combined with the cathode and other structural features that go to make up a tube, all within an evacuated envelope, as illustrated. Power oscillators and stable power amplifiers have been built for frequency bands beyond the reach of prewar equipment. Small signal preamplifiers and frequency multipliers also have been built in such Lighthouse design. The type 2C40 (illustrated) is a suitable amplifier, converter, or local oscillator in a receiver employing a 250-volt plate supply; plate current is 25 ma. It is exceptionally suitable for FM and television equipment.

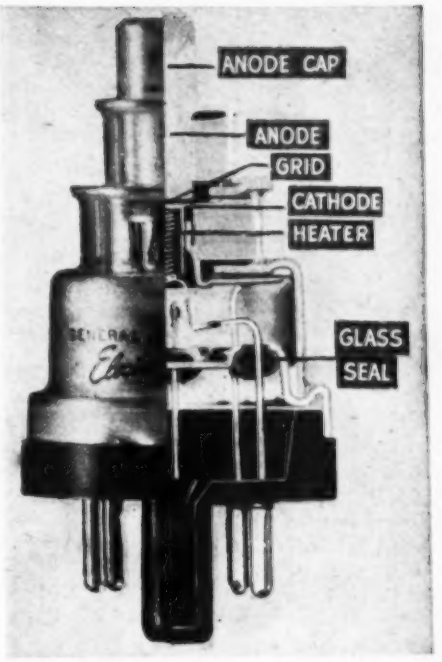
Amperex 233—this tube has been designed for use as a class "C" oscillator or amplifier for generating radio frequency power at frequencies up to 30 megacycles. Two grid arms make neutralization more convenient in the amplifier connection, and also permit cooler operation of the grid when the tube is employed at higher frequencies in either a self-excited oscillator or a power amplifier.

Super-tiny tube — Raytheon CK-510X; newest contribution to the small-space series. It is a dual space-charge tetrode audio amplifier 1½" long x 7/16" wide x 5/16" thick. It incorporates a space-grid around the filament, this arrangement producing 2 virtual cathodes. This results in securing 2 tetrodes, in one envelope, from a single .625-volt 50 ma. filament. Only a 45 v. plate supply is required, and the voltage gain is approximately 250. It is ideal for small-space portables.

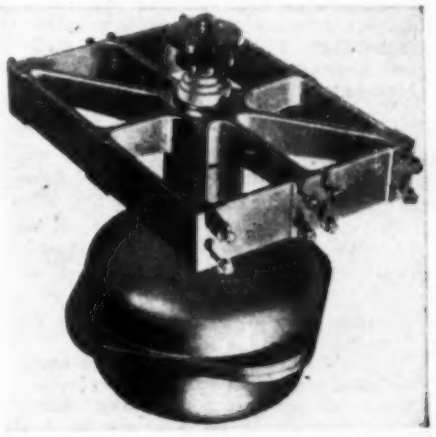
Sylvania's new 7F8, a stubby twin-triode loctal-base tube having high mutual conductance (5000 to 7000 micromhos) is designed for use at frequencies up to at least 400 mc. It is useful in grounded grid and cathode follower amplifier service, by connecting its twin sections in cascade, and is OK as a converter, or as a push-pull amplifier.

Consider these rectifier characteristics: output, 1½ ma. at 1000 v. (d.c.); filament drain 100 ma. at 1.4 v.; size (over-all), approximately ½" dia. x 2¼" long. Such are the specifications, in brief, of Raytheon's almost instant-heating 2B25 miniature high-voltage, high-vacuum rectifier, particularly useful as a rectifier in (battery) vibrator power supplies. A new cold-cathode rectifier, the 1B48 is made in the same size envelope.

A very-high frequency triode pulse oscillator has been announced by Hytron. It is the type 2C26A (approximately the size of a 50L6GT bantam), capable of delivering 2 kw. pulses of useful r.f. power at 200 mc.; max. frequency rating is 300 mc. The base is a standard octal.

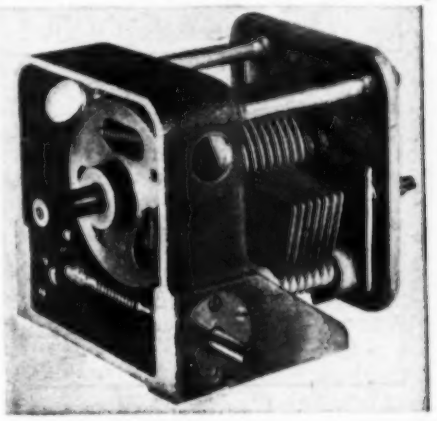


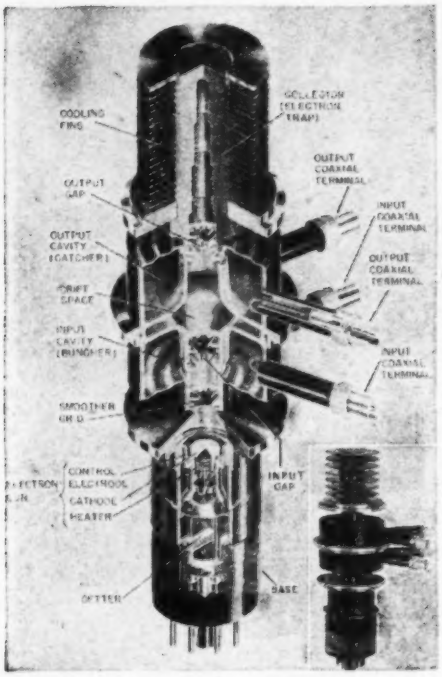
Type 2C40 Lighthouse tube, a 6-watt triode r.f. amplifier, converter, or local oscillator, in an interior and exterior view.



A selsyn-type motor rotates platform of latest rotary beam antenna (illustrated). Another rotates a remote antenna position indicator. Both are interconnected.

Fig. 14. A worm-drive variable condenser. Suitable for tuning to 250 mc. (harmonic). Same type but with lower maximum capacity is usable on frequencies to 1000 mc.



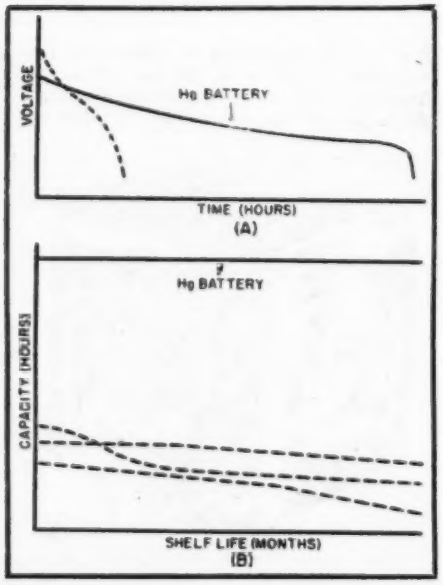


The type 410R Klystron tube usable as a microwave generator or amplifier, or as a detector. A closely-guarded war secret now released, in part: a velocity-modulation tube utilizing the transit time between two points to produce (from about 500 v. and 80 ma., d.c.) an alternating current which delivers high power to a cavity resonator.

The very-high frequencies soon to be again opened to ham investigation will spur the development and sale of amateur-type magnetron tubes, the klystron or velocity-modulated u.h.f. tube, dynatrons and similar special tubes. Klystrons, first developed by Sperry Gyroscope, will probably be available in power ratings suitable for the ham rig. They supply easily-modulated signals at very-high frequencies; also, they may be used in amplifier and multiplier circuits. By means of a single knob klystrons may be tuned over a wide frequency band.

It may be of interest to note that the British type VR91 radar tube was modified by Sylvania and produced in large quantity as the EF50, for use in 284 different kinds of radar equipment. This special type of receiver tube may be introduced at some future date for civilian applications if conditions warrant.

Fig. 4. Qualitative comparison of hermetically-sealed "mercury" battery (solid lines) and conventional or "zinc" batteries (dotted lines), as to service life (A) and shelf life (B), as employed in Signal Corps "handie-talkie." It is possible that "civilian" types of the new long-life battery may be available to hams in 1946.



Coils.—General-purpose rotary coils, or *air inductors* may soon be available, from Barker & Williamson, and Johnson (to name only two) in a variety of styles and sizes. Since the inductance is varied by the action of the coil as it rotates, under a contactor, like a screw, a variable capacitor is not required.

Ultra-high-frequency coils of more conventional form were developed for the armed forces by Barker & Williamson, Hammarlund, and others, and exactly meet amateur needs. The postwar *coil,* or r.f. or i.f. inductance as made by Sickles, will be a far cry from the coil of other days. Their new coil will be hermetically sealed in a drawn-zinc can, connection being made through fused-in, metal-to-glass bushings. All adjustments are enclosed, and sealed with neoprene gaskets. Hermetically-sealed r.f. choke coils have been produced by Hanovia.

Crystals.—With the relaxation of wartime restrictions, better quartz crystals now will be made available to radio amateurs and at extremely low cost due to mass production and other facilities. One such facility, developed by Bliley, is the acid-etching of quartz crystals to frequency.

Resistors. — Thermal resistors are another wartime development, insofar as wide usage is concerned, there having been only limited production for use mainly by certain utilities in the prewar period. The positive temperature coefficient of copper (for example) may be compensated in a circuit to a certain extent by the use of carbon resistors, which exhibit negative resistance characteristics, but this may result in impaired performance (lowered output, etc.), due to excessive increase of circuit resistance. However, by using a lower value of resistance, with high negative temperature coefficient, compensation may be adequate. Thermal resistors possess these qualities, and although not made of carbon, certain Keystone NTC units afford close compensation over a range as wide as—55° to + 150°C.

Globar resistors, before the war, were found almost exclusively in commercial equipment; now, because of their non-inductive characteristic, they will be employed in ham apparatus (for instance as termination resistors in rhombic antennas, and as the resistive element in dummy antennas). They are valuable for their negative resistance voltage characteristics, especially desirable for limiting voltage peaks for protective purposes by stabilizing circuits supplied by rectifiers to limit the peak voltage, for control of voltage circuits in electronic devices, and for other services.

Sprague will offer tropicalized resistors as a stock item. They are wound with ceramic-insulated wire, on glazed ceramic shells, and with special end-seals, and are desirable for equipment intended for humid climates.

Another contribution to small-space components is IRC's fingertip control —a potentiometer ¼" thick (front of panel) x ⅞" diameter; only mounting screws extend through panel. The resistance element is contained inside the knob, remains stationary as the knob is turned.

Hermetically-sealed resistors, accurate to ±0.1% of rated resistance values, are made by Daven. Each sealed-ohm unit is housed in a drawn-brass case; leads feed through glass seals in the case.

Resistance values to 1,000,000 megohms are obtainable, for special work (particularly in cathode-ray equipment) in resistors made by S. S. White and Victoreen.

Capacitors.—New vacuum capacitors, 1/10th the size of air capacitors of equivalent voltage rating, are available for use at voltages of 7000 to 16,000 (peak). They are unaffected by external conditions (heat, humidity, air pressure, etc.). Three companies manufacturing these capacitors are: Industrial & Commercial Electronics, General Electric, and Jennings.

Where temperature compensation may be achieved through the use of a condenser, modern units afford a temperature coefficient (negative or positive, as desired) between —870 and + 150 parts/million/°C., as for example in certain Erie ceramicons and Centralab units.

An interesting sidelight on the effect of the war on prewar equipment is shown in Aerovox stack-mounting mica capacitors. Previously available only to order and at custom-built prices, the techniques of quantity production have brought this component into line with other popular-priced units. Uses (in heavy-duty transmitters, especially): grid and plate blocking, tank and bypass functions.

Megohms/microfarad. — Something new has been contributed to Sprague capacitors, increasing leakage resistance at room temperature to 20,000 megohms/microfarad, or 5 times better than previous type. A new oil impregnant makes this possible.

Precision worm-drive variable capacitors developed by Cardwell and Hammarlund have found use in Government frequency meters. Part #4.200, for example, tunes the oscillator over a range of 20-40 mc. (fundamental), and 250 mc. (harmonics), with a capacity range of 15-125 μμfd. Another model, of even greater interest to the ham, has a minimum capacity of 8 μμfd. and tunes harmonics to

(*Continued on page* 76)

By CARL COLEMAN

PACIFIC-GULF District, American Communications Association (CIO), Marine Department, requested all merchant marine radio officers to forego furloughs and report to the union's hiring halls for immediate assignments to vessels on the Pacific Coast and at Gulf ports to be used in the speedy return of veterans from the Pacific war fronts, George F. B. King, president of the local union announced when the surrender of Japan was received. The ACA president at the same time wired Admiral Emory S. Land, War Shipping Administrator, that the union is "rededicated to and will intensify its efforts toward the continued sailing of ships to guarantee the speedy return of our fighting forces as promptly as possible from overseas."

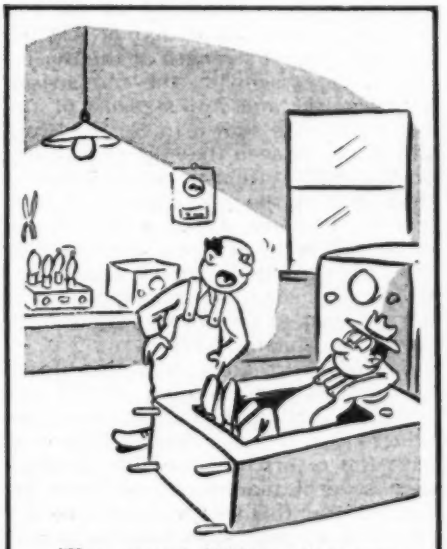
"We know that this effort will impose another hardship upon the membership of our organization but we also know that mothers, wives and sweethearts of our men in the Pacific anxiously await the return of our fighting forces to whom we owe so much," King stated. "Accordingly, it is just another duty of the men in the merchant marine to arise to this occasion and contribute fully to this huge task. The cancellation of furloughs will permit the manning of vessels in the safest possible manner by providing manpower for a twenty-four hour, round-the-clock radio watch aboard merchant ships carrying thousands of war-weary veterans on the long road back home. No radio officer will ignore this important call to duty under such circumstances." The above was sent in by Harry A. Morgan who is now at Local 3, in San Francisco.

D. H. OWENS sailed recently from the big city, taking out a cargo assignment. . . . J. Telle also took out a cargo vessel. . . . Letter from Carl Amato, with ACS way up north, who is interested in getting back into the marine end of radio as soon as the Army no longer requires his services. Carl was marine serviceman in New York, for some time, a few years ago. . . . O. Thompson was assigned to a freighter recently. . . . L. Hvidsten recently reported from Australia where he is still roaming aboard his cargo craft. . . . H. Sande has taken out a tanker. . . . W. Glazar not heard from for some time lately.

M. Dillas out with a cargo assignment recently from the big town. . . . Robert Lacey in town recently after another long voyage. Bob is looking around for a shore berth, we understand, for a change from the Liberty craft. . . . K. Sovig out on a freighter.

MASSACHUSETTS Institute of Technology recently disclosed new type radar equipment which has been designed for the Army, to be used ashore. The announcement disclosed that the new set will "completely revolutionize" American coastal artillery defense and also guide incoming ships through fog and darkness even though the ships themselves lack radar. The equipment can detect vessels, at least twenty five miles out to sea, under the worst weather conditions. Its accuracy of detection is within five yards in any direction within twelve miles, which will enable coastal guns to fire perfect *first shots*. Non-military use will allow the vessels of the merchant marine to be directed to a safe anchorage. The operator ashore, having a near motion picture of the incoming ship on his screen, will be able to radio telephone or radio telegraph his instructions to the vessel, guiding it past all obstructions.

LETTER from Jack Winocur, ACA international representative, with a copy of "ACA Postwar Technical Plan for Marine Communications," which covers quite a lot of territory. However, we think it worth studying over and will give you the high points. It concerns the improvement of equipment, which prior to the war was sadly needed aboard merchant marine vessels. The article starts off with an introduction pointing out the advantages of radio to commercial shipping and noting that the "ranges and quality of reception and transmission have advanced by leaps and bounds since the first distress call sent by a merchant ship. . . . Prior to the war, despite the advances in radio design and engineering, and equipment, the radio facilities of the merchant marine by and large lagged behind the equipment being utilized in other fields of communications."



"You weren't kidding when you said you wanted a career in radio, were you, Sweeney?"

It was also noted that "it was not, in fact, until 1940 that the last American vessel equipped with spark transmission had been equipped with modern vacuum tube equipment." The proposals follow in condensed form: Continuous watch. The present auto alarm to be removed and three men assigned to all compulsorily equipped ships. "The placement of radar aboard ships and the constantly expanding maintenance requirements of fathometers, radio direction finders, and other shipboard electronic devices all point to the need for more radio officers. This need should be met."

A high-frequency transmitter should use both ECO and xtal, with provisions for A2 of at least 500 cycles, and the h.f. xmtr. to be capable of operation from both mains and emergency power supplies. The h.f. xmtr. should be able to operate in the marine bands 18, 24, 27, 36, 48, 54, and 96 meters. Another proposal was a good h.f. receiver with two stages of pre-selection and an intermediate and low frequency receiver with at least two stages of tuned radio frequency.

The suggestion was also made to do away with the present day useless crystal emergency receiver and replace it with a tube receiver which would operate from a battery power supply and incorporate one r.f. and two audio stages. Dry battery operation was suggested, with the tubes designed for operation from this type power supply.

"It was pointed out that there should be two permanently installed lifeboat radio units, one on either side of the ship, and it is suggested that the power output be increased to 25 watts in place of the present 5 watt units which are battery operated. The new units would be hand generator operated, with 25 watts output. (May we point out that a transmitter of this size would require at least two men to turn the hand generator.) We cannot give you much dope as yet but the new portables operated by a hand gen-

(*Continued on page* 141)

FM for HAM USE

By RAY FRANK, W9JU

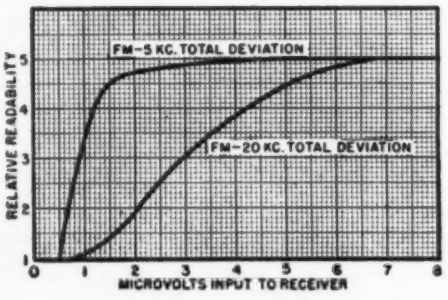
An explanation of the advantages of FM over AM and the choice of deviation ratio for best results.

ALTHOUGH FM stations have been on the air with regular commercial schedules for the past six years, the average amateur has evidenced little or no interest in the adaptation of this superior method of transmission to his own use. Doubtless, a good deal of this lethargy is due to the feeling that FM equipment is too complicated, plus a lack of knowledge of the many advantages to be gained by its adoption.

The general opinion that FM is complicated is probably due to the impression gained from the complex circuits used in broadcast equipment. However, equipment to suit the needs of amateurs may be much simpler than that necessary for the same power using AM modulation.

Let us first examine the requirements for the transmitter. Disregarding the method of frequency variation, the transmitter is entirely conventional and consists of the usual oscillator, doublers, and final amplifier. As the input to the final stage remains constant with modulation, the manufacturer's ratings for telegraph operation may be used for the input to the final in place of the reduced ratings necessary with AM modulation. While the figures vary with different tubes, it is safe to say that in general, it is possible to run from twenty-five to seventy-five per-cent more input when the tubes are used on FM. This, in itself, makes the *watts per dollar* cost of the transmitter much lower.

Fig. 2. Comparisons of readability of stations using deviation ratios of 1 to 4.



The modulator, instead of being a unit capable of furnishing audio power equivalent to half that of the final input power, consists of only two or three small audio tubes.

As the power supply has only the steady load of the r.f. section to furnish, the design requirements are much simpler as it is not necessary for the supply to have the excellent regulation needed with class "B" modulation.

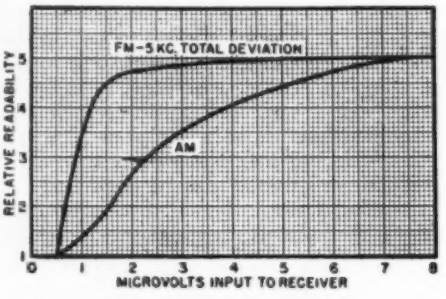


Fig. 1. Chart shows comparison between FM and AM stations of the same power.

In addition to the constructional advantages, the readability of an FM station is better than that of AM for the same signal strength at the receiver. A chart showing the comparison between FM and AM stations of the same power is shown in Fig. 1. From this it can be seen that the readability of the FM station is always better than that of the AM station. This is due to the noise suppression feature of the FM receiver along with the fact that the strongest carrier takes control in FM reception provided that it has at least twice the signal strength of the interfering carrier.

One of the greatest stumbling blocks to the amateur adoption of FM has been the high cost of satisfactory receivers for this service. However, with the return to peacetime production, several manufacturers have indicated that this will no longer be the case and we may soon look for versatile high-frequency receivers covering both FM and AM reception at a price comparable with that of the standard communication receivers of equivalent quality.

Before there can be any widespread use of FM for amateurs, it will be necessary to establish some sort of tentative standards for maximum bandwidth and deviation ratio. As the only objective of amateur transmission is the transmission of intelligibility, it would be well to limit the upper frequency limit to 2500 cycles. This limit has proved adequate in telephone work and includes all the frequencies encountered in speech. If these limits were adhered to in AM transmission, much of the present interference would be eliminated and operation would be much more pleasurable.

The next factor to consider is that of deviation ratio. For high fidelity broadcast work where it is desired to transmit the entire audio spectrum, a deviation ratio of five is usually used.

The term *deviation ratio* may best be described as the ratio of one-half the maximum variation in transmitter output frequency to the highest audio frequency to be transmitted. For example, if we use a maximum audio frequency of 2500 cycles and the output frequency of the transmitter varies 10,000 cycles each side of the center frequency, the deviation ratio is said to be four. The *total* deviation in this case would be 20 kc.

The primary purpose of a communication system is to transmit intelligibility the maximum distance with a minimum of power. If the band width is made too wide, the signal to noise ratio of the receiver suffers. This holds true at the low levels of signal usually encountered in amateur work. What we are striving to attain is the ability to receive weak signals.

When the band width of the receiver is made just wide enough to receive the transmitted signal without distortion, the gain of the receiver can be made much higher due to the elimination of loading resistors usually used to broaden the band for wide band work. Due to this additional gain, in some cases it is possible to eliminate one of the i.f. stages, or use the same number of stages and take advantage of the additional gain.

If a deviation ratio of one is selected for the transmitter, and filters used to limit the audio response to 2500 cycles, the band width under maximum deviation is only 5 kc. total, or the same as it would be using AM modulation. Thus, in one step, we have ac-

complished the dual purpose of a narrow band requiring no more space than AM, along with the additional advantages of FM.

There is no advantage in going below a deviation ratio of one as the bandwidth occupied does not decrease below that occupied when the ratio is one. In addition, the received signal strength will fall off.

Comparisons of readability of stations using deviation ratios of one and four respectively are shown in Fig. 2. It is apparent from these curves that the readability of the signal increases with a decrease in deviation ratio. The minimum readable signal decreases in proportion to the square root of the ratios of the two relative deviations. Comparing the two ratios of one and four, this means that simply by changing the deviation ratio we get the same effect as increasing the transmitter power, insofar as the readability of the received signal is concerned.

Two general methods of frequency modulation are generally used commercially although there are several variations of these systems. These are the Armstrong, or phase modulation method, and the reactance tube method, more widely used, and ideal for amateur use. The Armstrong system, while satisfactory for broadcast use, is too complicated for amateurs.

Methods of reactance tube modulation vary from the simplest ones using a single reactance tube connected across the oscillator tank circuit to the complex systems used in broadcast work, in which there is a control system consisting of a crystal oscillator and discriminator to maintain the transmitter on assigned frequency.

In Fig. 3 the simple type of circuit is shown. Any variations in the plate voltage of the reactance tube will manifest themselves as frequency variations and the only solution to this condition is the use of voltage regulation for the plate supply of both the reactance tube and the oscillator.

The voltage regulation may be omitted if the push-pull circuit of Fig. 4 is used. In this circuit, any fluctuation in the supply voltage is applied equally to the two modulator tubes with the result that the effect of this fluctuation cancels out.

A more complicated system, approaching that used in broadcast work, is shown in Fig. 5. Here we use a single reactance tube, although alternately push-pull tubes as in Fig. 4 may be used. Part of the oscillator output is coupled into a mixer tube, one section of the tube being used as a crystal oscillator. The frequency of this crystal oscillator is such that either the fundamental crystal frequency or one of its lower harmonics will beat with the transmitter oscillator frequency to give a difference frequency of 455 kc. or some other convenient low value. This difference frequency is then fed into the discriminator transformer.

Any variation in the transmitter frequency, beating with the crystal oscillator, will then cause a voltage to be developed across the output of the discriminator. The polarity of this output voltage will depend on whether the transmitter frequency shifted upward or downward.

This voltage is then applied to one of the grids of the reactance tube and serves to bring the frequency back to normal. It is necessary to prevent this change from taking place instantly or there would be no modulation as the correction would be too rapid. This time delay must be such that audio frequency variations normally encountered in transmission will not affect the frequency. A satisfactory value for this time delay in amateur work, where the lowest frequency that must be transmitted is something over 100 cycles, is .05 seconds. The values of constants shown for R and C in Fig. 5 will be suitable for these frequencies.

The widespread adoption of narrow band FM for amateur use will result in much more satisfactory contacts due to the elimination of much of the interference. The simplicity of the apparatus should appeal to all, once some of the false mystery surrounding FM has been eliminated. -30-

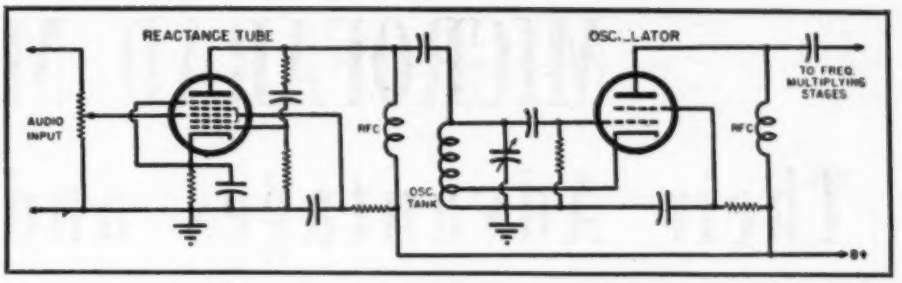


Fig. 3. A simple single-tube reactance modulator applied to the oscillator of a transmitter.

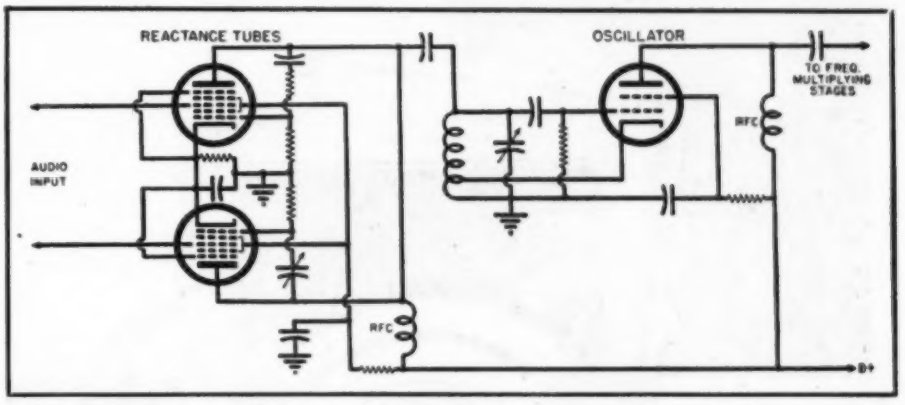


Fig. 4. Push-pull reactance modulator in which supply voltage variations cancel out.

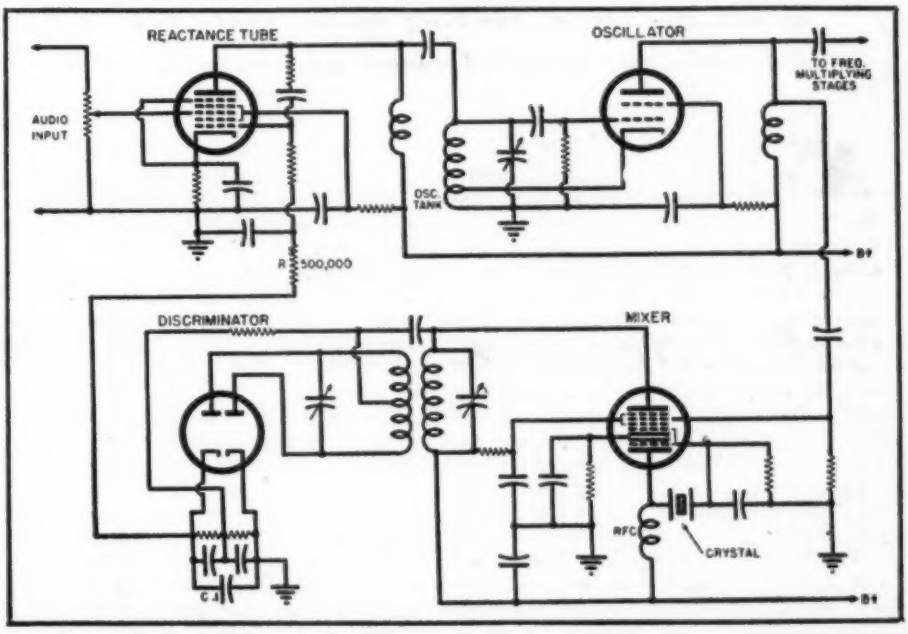
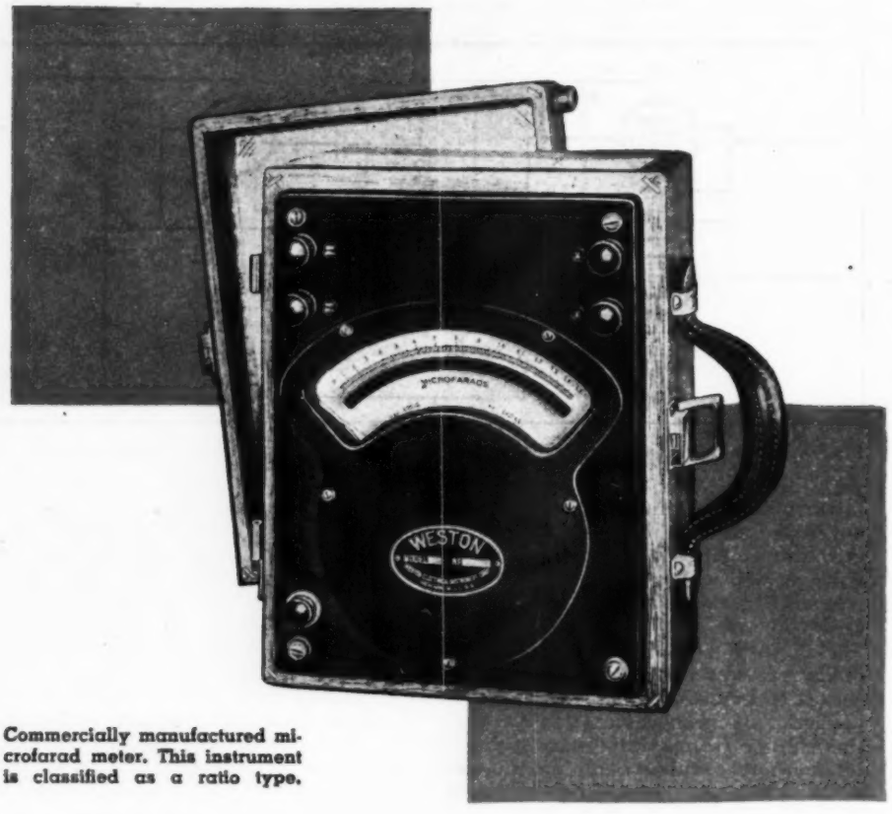


Fig. 5. Stabilized frequency control achieved by mixing part of the output with crystal oscillator and applying the developed voltage to the control of the reactance tube.

MICROFARAD METERS

Their Advantages and Limitations

By
RUFUS P. TURNER
Consulting Eng., RADIO NEWS



Commercially manufactured microfarad meter. This instrument is classified as a ratio type.

A discussion of various types of microfarad meters. These meters are, perhaps, the trickiest of all the direct reading instruments that are available to the serviceman and experimenter.

ANY non-electronic indicating meter has two understandable advantages. Its readings are direct, or very nearly so, and the instrument requires no adjusting or balancing manipulations. Such instruments permit speed and simplicity in testing and trouble shooting. Common instruments offering these advantages include ammeters, voltmeters, wattmeters, watt-hour meters, power factor meters, etc. Ohmmeters and the general class of electronic meters require some adjustment, if only to obtain an initial zero setting, but most of these may be regarded as simple instruments.

Electrical and radio servicemen favor meters of all kinds over bridges and other instruments which must be manipulated in order to obtain a reading. This preference is understandable in the light of the advantages mentioned in the foregoing paragraph. A busy repairman may make many hundred tests in a working day. He has neither the time nor the inclination to balance a bridge so many times or to make settings on a complicated instrument if readings can be taken from the simple, direct-reading scale of a test meter.

The serviceman's determination to employ meters in every possible test operation extends to the measurement of capacitor characteristics, particularly of capacitance. Most modern radio set analyzers and a few tube testers have microfarad meter positions. However, the simple microfarad meter does not share the accuracy of the service ammeter, voltmeter, or ohmmeter. Its indications may not be accurate within several per-cent of true capacitance values, since its deflections are not governed entirely by the *capacitance* of the test capacitor. In some operations, the approximate values indicated by the simple microfarad meter may be sufficiently accurate. In still other operations, the error of this type of meter may render its indications unsuitable even for comparative purposes or for spot checking. This article will discuss the common types of simple microfarad meters.

Capacitor manufacturers have made exhaustive investigations on all sorts of capacitor testing instruments. This research is being carried on constantly. In some plants, reliable instruments of various designs are in continuous operation for close checking and spot checking of capacitance. The closest checks still are made by means of bridge tests. Rapid spot checking, however, is within the province of the microfarad meter. Some of this equipment was designed by capacitor engineers, the rest by instrument specialists. We have interviewed some of these capacitor engineers and capacitor inspectors and have obtained much interesting comment and data on the advantages and limitations of various capacitance testing instruments. In devoting this article to a discussion of the advantages and limitations of microfarad meters, we propose to present a compact, bird's-eye view of the state of the art. It is not our intention consciously to provoke a controversy in which, frankly, we do not have the time to engage, but rather to simplify the quantitative data we have assembled in order that the serviceman may know just how much to expect of his microfarad meter.

Advantages of the Microfarad Meter

The microfarad meter will indicate the capacitance of a test capacitor directly in microfarads when the capacitor is connected to the meter terminals. The test operation thus is reduced to the simplicity that characterizes the checking of a resistor with an ohmmeter. Simple microfarad meters are readily portable; most of them require no manipulation other than range selection and they operate at reasonably low values of alternating voltage. A capacitor-checking cir-

cuit may be included in a service multimeter and made available through the regular range selector switch of the meter. Through this expedient, microfarads, as well as volts, ohms, and milliamperes, may be checked with a single meter. These are distinct advantages which are strong selling points to the busy repairman. The disadvantages of the microfarad meter will be apparent from the following discussion of the theory of each type. Whether these disadvantages outlaw the microfarad meter depends entirely upon the stringency of a particular application, upon the standards set by the serviceman, and upon the capacitance tolerance that may be permissible in a given circuit.

In its most common forms, the microfarad meter appears as (1) the reactance-type meter instrument, (2) a.c. ohmmeter-type, and (3) ratio-type meter. The heterodyne capacitance meter is a relatively new type. These arrangements will be described separately.

Reactance Type Meter

The simplest type of microfarad meter is illustrated by the schematic, Fig. 1. Here, a known value of alternating voltage is applied to the capacitor under test and the resulting current flow is measured by means of a rectifier-type a.c. milliammeter. Operation of this circuit assumes that the test capacitor is a pure reactance. If this were true, the current *(I)*, in milliamperes, flowing as a result of the applied voltage *(E)* might be determined by means of the equation:

(1) $I = 0.00628\, f\, C\, E$

From which:

(2) $C = I/(0.00628\, f\, E)$

and the a.c. milliammeter scale might be graduated directly in microfarads in accordance with calculations from equation (2). In both of the above equations, C is in microfarads, f in cycles-per-second, and E in volts r.m.s.

Even if pure capacitive reactance were all that we had to deal with in this circuit, we still would have the problem of maintaining voltage E and frequency f constant, since the meter deflection is directly proportional to each of these quantities, as well as to the capacitance.

But we have more opposition to the flow of alternating current, through the circuit of Fig. 1, than capacitive reactance alone. The capacitor has a resistive *(R)* as well as a reactive *(X)* component, and these two will combine to form impedance *(Z)*. Although the capacitance may be a certain value, it will not appear so on the meter scale graduated according to reactance, because the deflection will be proportional to E/Z instead of E/X. In high-grade mica capacitors, the R/Z ratio (or *power factor)* is small, and little error is introduced in the simple microfarad meter indications. But with other types, especially electrolytic capacitors, having large amounts of equivalent series resistance with respect to reactance (high power factor), the error will be considerable. It is difficult to appraise R, except by means of bridge measurement of capacitor power factor; and, hence, it is not possible, in the absence of a power factor or Q measurement, to determine in any simple way the extent of a correction factor which must be applied to a particular reading of the microfarad meter. The microfarad meter indication gives no hint that an error has been introduced by the capacitor's resistive component.

If the capacitance range of the reactance-type meter is to be wide enough to include the numerous capacitances employed in electronic circuits, either the input voltage must be made adjustable to different values, preferably in decade relationship, or the milliammeter range must be made adjustable. If the test voltage is varied, care must be taken that its value never exceeds the safe a.c. limit for capacitors under test. This is not always a simple matter in wide-range capacitance measurements. In general, there will be some difficulty in maintaining both voltage and frequency steady enough in simple meters to guarantee good accuracy.

This simple circuit and its theory neglect internal resistance of the meter which in the case of a rectifier-type 0-1 milliammeter might amount to as much as 400 ohms. This resistance varies with instruments, its effect being to convert the milliammeter into an a.c. voltmeter. The next circuit described takes this resistance into account.

A pronounced disadvantage of the simple reactance-type meter is the tendency toward crowding of graduations at one end of its scale. This is because capacitive reactance, on which the scale is based, is a reciprocal quantity. The crowding is severe enough to reduce the accuracy of reading appreciably in the affected region. At safe values of alternating test voltage, a practical microfarad meter of this type rarely reaches higher capacitance values than about 0.25 μfd. If the scale is graduated in microfarads, it will be forward-reading; that is, the lower capacitance values will fall in the low-milliampere positions.

A. C. Ohmmeter-Type

A second type of simple microfarad meter is shown in Fig. 2. This circuit takes the form of an a.c.-operated ohmmeter. As in other ohmmeters, the instrument itself is a voltmeter comprising a milliammeter and series multiplier resistors. In this case, the indicating instrument is a rectifier-type a.c. milliammeter and the multiplier is an external non-inductive series resistor, R (or a capacitor having a reactance value equal to R), plus the internal resistance, r, of the meter (combined resistance of meter and rectifier).

This circuit, like the one in Fig. 1, is intended to *see* the test capacitor as pure reactance. If the test capacitor were composed entirely of reactance *(X)*, then the relation of this quantity to the meter deflection and circuit resistances would be shown by the following equation:

(*Continued on page* 144)

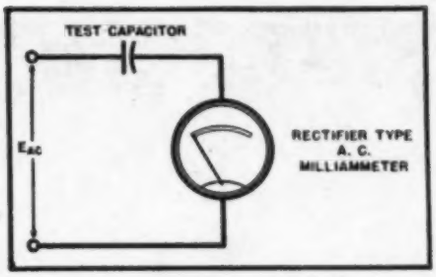


Fig. 1. Reactance-type meter.

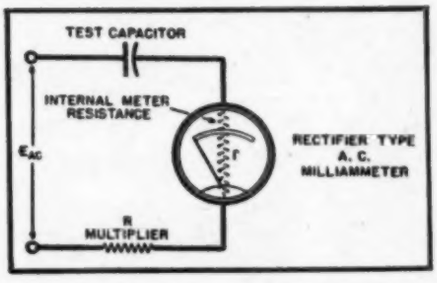


Fig. 2. A.c. ohmmeter-type instrument.

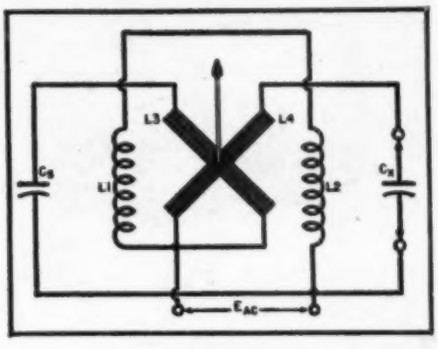
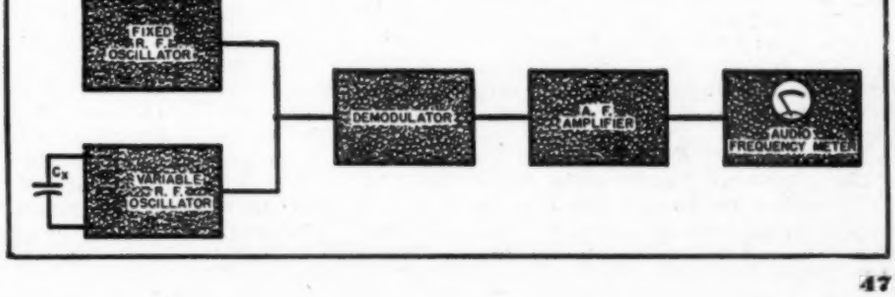
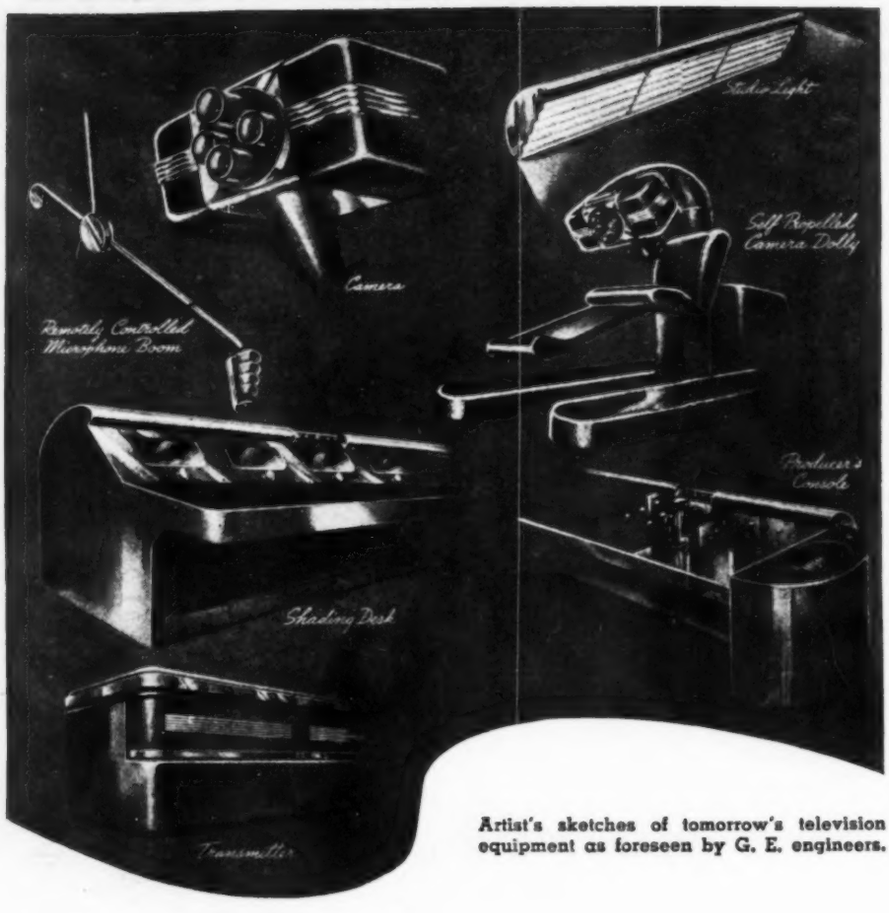


Fig. 3. Ratio-type meter.

Fig. 4. Heterodyne capacitance meter.





Artist's sketches of tomorrow's television equipment as foreseen by G. E. engineers.

Functions of VIDEO CIRCUIT

By EDWARD M. NOLL
Television Tech Enterprises

Part 10. Theoretical design and operation of the video section of a television receiver.

THE three major tasks performed by the video section of the television receiver are: (1) amplifies the picture signal, (2) applies properly polarized signal to the picture tube control grid, and (3) establishes the average brightness of the picture. October's installment discussed only the amplification of the video signal.

Signal Polarity

The polarity of the composite signal on the grid of the picture tube is negative, swinging from zero to some negative value which represents the picture tube bias level at which the screen blacks out. Thus, in the G. E. model 90, with two stages of video, Fig. 1, a positive signal appears on the grid of the video output stage, and a negative on the grid of the first video amplifier. Consequently, the diode detector output signal must be negative in polarity, and the diode so connected as to deliver the required negative signal. To obtain a negative output, the cathode is above r.f. ground, as shown, and the diode plate is at r.f. ground. Another advantage of this inverted connection is that the input capacity is less with cathode above ground than with plate above ground.

Average Brightness

Typical composite television signals are shown in Fig. 2. They are shown with positive polarity for ease in explanation. These drawings illustrate the relative positions of the various signal components, how the picture signal varies between constant blanking and sync levels, and demonstrate average brightness, relative brightness, and extremely intense or dark spots. Each of the drawings represents the signal distribution along one line.

In drawing (A), point *A* is an extremely dark spot on the picture and point *B* an extremely intense spot. The sharp change between *A* and *B* represents a rapid shift between dark and light.

In drawing (B), the relative light distribution along one line is shown. Since almost the entire signal is located at a fairly high voltage level (near to the black level), it represents a line with a low average brightness. This observation clarifies the negative modulation characteristics of the transmitted television signal because the darker the scene the greater the power output, and the greater the detected signal. Thus, when a dark spot is transmitted, the instantaneous power is high. Likewise, when blanking is transmitted, the instantaneous power is high, and furthermore, power output is maximum during the transmission of the sync pulse which exceeds in amplitude the blanking level or any dark spot of the televised scene. Although the average brightness is low, there can be intense or bright spots in the transmitted scene, such as point *C*, which represents a very brilliant spot.

In drawing (C), the relative light distribution is essentially the same as that of drawing (B); however, the average brightness is higher, for the entire signal is at a lower voltage level (approaching the white or maximum intensity level).

In drawing (D), there is a gradual decline in screen illumination as the beam moves from left to right across the screen.

As stated previously, each drawing represents the light distribution along a single line. If the same average brightness, as shown on any one drawing, is maintained throughout the total number of active lines for one frame, the average brightness of that frame is set. When the average brightness of the scene televised changes, the background level or average brightness of the reproduced picture follows. Likewise, if the average brightness of the televised scene changes from top to bottom, the background brightness follows.

Snapshots form an effective analogy of light distribution. For example, a snapshot showing sky and shady terrain represents a change in average brightness from high to low, top to bottom. Two snapshots can be used

to distinguish between relative and average brightness. For example, the same object snapped before a sunlit background has essentially the same relative light distribution and still the average brightness of the two snapshots differ.

The composite television signal, consisting of picture, sync, and blanking, is increased in amplitude by the first video amplifier and applied as a positively polarized signal, such as might appear as shown in Fig. 2, to the video output stage.

D.c. Restoration

In addition to supplying a properly polarized signal to the picture tube grid, the level at which blanking occurs must be held constant. Thus, the blanking level of the signal (level at which the screen is to black out) must always coincide with the picture tube control grid voltage level at which the screen blacks out. If some means were not employed to hold the blanking level constant at a prescribed level, it would continually vary up and down as the average content of the signal changes. This average content does change, as demonstrated in Fig. 2, when the average brightness of the televised scene varies.

Shift in the blanking level is caused by the charge and discharge characteristics of the usual resistance-capacitor interstage coupling circuit. This defect is demonstrated in Fig. 3, which shows the effects of the capacitor on the signal distribution. In passing the composite signal from detector to video amplifier to the grid of the video output stage, the signal has been capacitively coupled. Consequently, the signal has arranged itself as an average about a zero axis (equal signal distribution above and below the axis). Thus, if a signal, such as A in Fig. 3, has a low average brightness (dark scene), after transfer by the capacitor it appears considerably reduced in amplitude when the signal has distributed itself equally on both sides of the zero level. Now, if our signal has a high average brightness (bright scene), the signal amplitude is greater. This means that on the grid of a tube with normal bias, signal A blanking level will appear at a lower grid voltage level than signal B blanking level. This, in turn, means that at the input of the picture tube, the blanking or black level of the signal would vary above and below the grid voltage level at which the picture tube blacks out. This failure, as illustrated in Fig. 4A, causes a number of defects in the reproduced picture, as follows:

1. The average light range or average brightness range of the picture is seriously impaired. Thus, a bright scene, signal 3, which has a small signal content, would raise the signal blanking level above the black-out bias of the picture tube. Therefore, the average brightness of the entire picture would be darker than intended, because the entire signal has been moved up on the light range voltage scale.

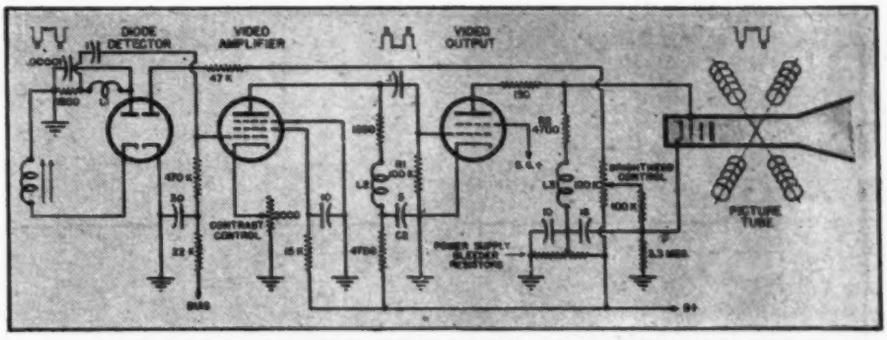


Fig. 1. Diagram of the video section of G. E. model 90 television receiver.

Now, if the signal were originally dark, signal 2, and had a large signal content, the blanking level of the signal would fall below the grid voltage level at which the picture tube blacks out. Therefore, the average brightness of the scene would be greater than intended.

2. The instantaneous light distribution is seriously impaired because the entire light range scale is displaced with changes in average brightness. Thus, if a certain small object had a fixed intensity, and moved in a scene where the background brightness varied, the intensity of the object would also vary. Another defect becomes apparent upon observation of signal 3. Points A and B are both black because the blanking level has been reached at the level of A. However, according to signal variation, point B was originally darker than point A. On the other hand, with a signal of low average brightness, signal 2, point C, which should be black, appears gray. It is apparent how the shifting black level affects the fidelity and light range of the reproduced picture.

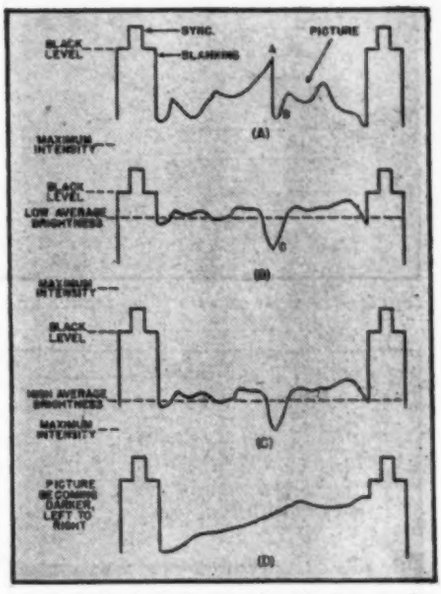


Fig. 2. Typical signals showing how variations in light distribution are obtained.

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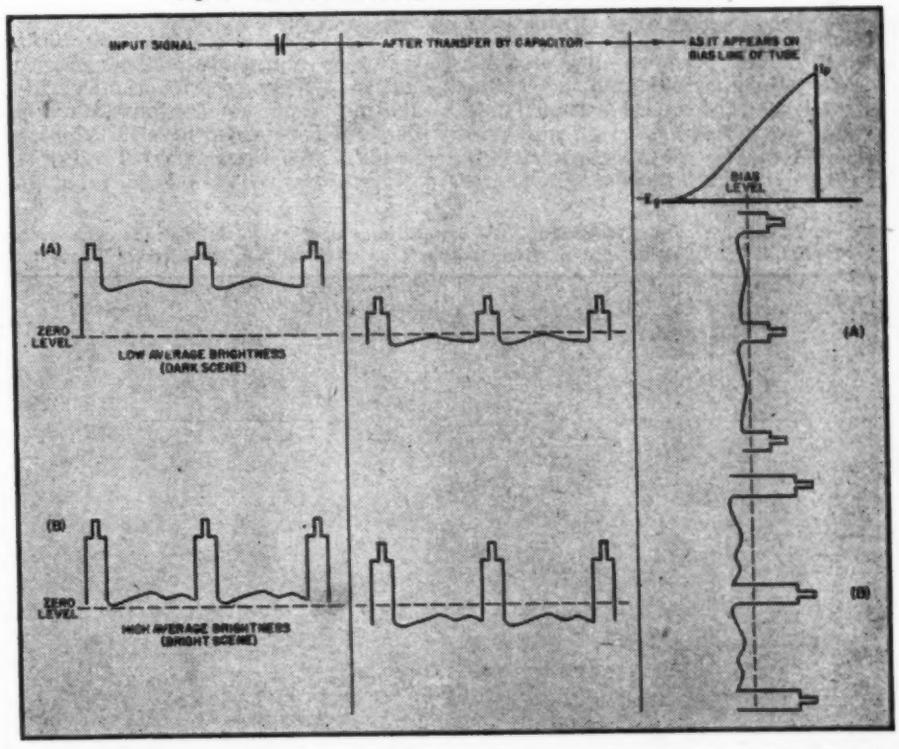
Fig. 3. The effect of a capacitor on the polarized signal.



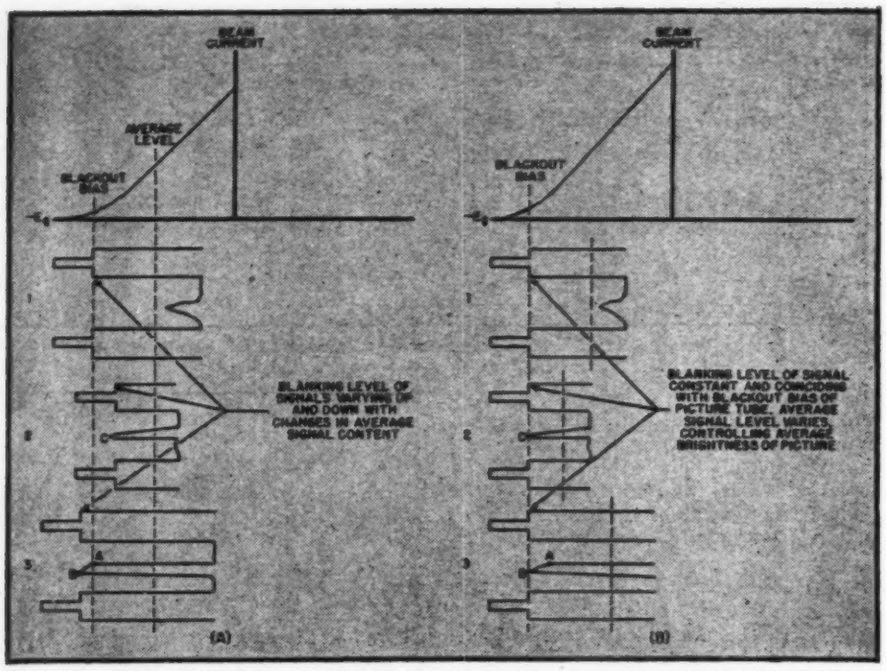

BEAM CURRENT
AVERAGE LEVEL
BLACKOUT BIAS
BLANKING LEVEL OF SIGNALS VARYING UP AND DOWN WITH CHANGES IN AVERAGE SIGNAL CONTENT
BLANKING LEVEL OF SIGNAL CONSTANT AND COINCIDING WITH BLACKOUT BIAS OF PICTURE TUBE. AVERAGE SIGNAL LEVEL VARIES, CONTROLLING AVERAGE BRIGHTNESS OF PICTURE
(A)
(B)

Fig. 4. Signal on picture tube control grid. (A) Without restoration. (B) With restoration.

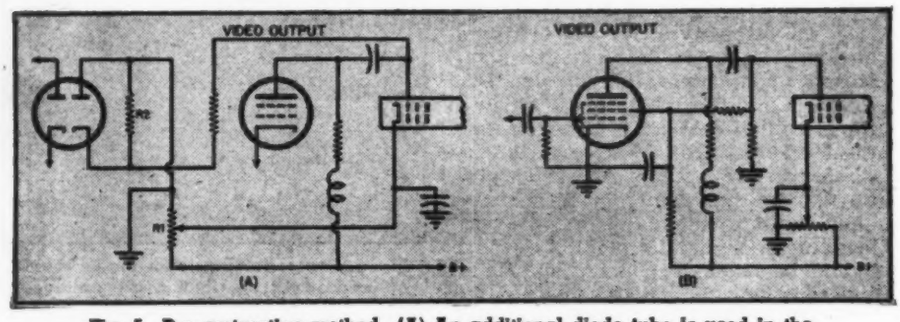


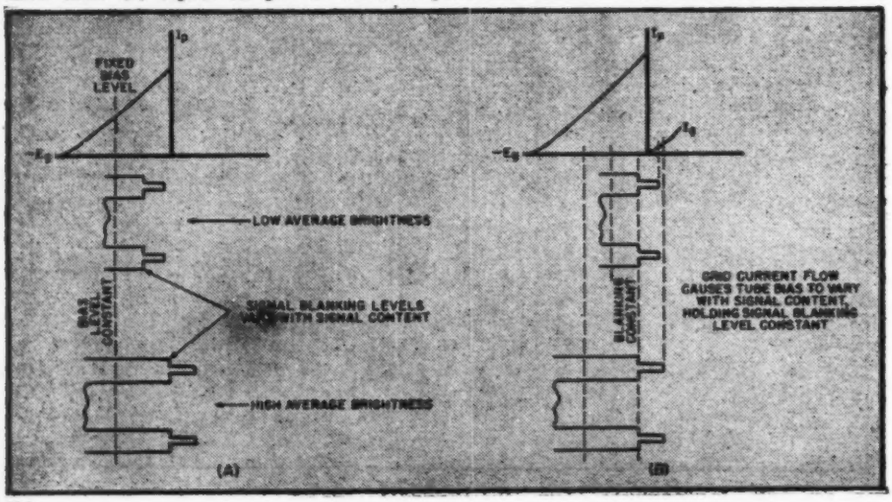
Fig. 5. D.c. restoration method. (A) An additional diode tube is used in the input circuit of the picture tube. (B) The variations in the screen current of a pentode output stage is used to establish the final blanking level.

3. When a signal of low average brightness, signal 2, is applied, another defect becomes apparent, because the signal blanking level is not at the picture tube black-out level. Thus, the screen is not completely blanked during the synchronizing interval and retrace lines become visible.

To overcome these defects, a fixed d.c. signal blanking level is established which is made to coincide with the black-out voltage level at the grid of the picture tube. The advantage and correction obtained by such a procedure is clearly demonstrated in Fig. 4B, which shows the blanking level of each signal, regardless of signal content, coinciding with the black-out grid voltage. Thus, each signal is properly aligned on the light range voltage scale according to its average brightness (dashed lines). Points A, B, and C now appear as originally transmitted.

In the model 90, the d.c. level is established at the grid circuit of the video output tube. The most constant voltage relation in the entire transmitted signal exists between the very tip of the sync pulse and the blanking level. There is only a very slight shift in this relation with changes in signal content. Therefore, the tips of these sync pulses by grid rectification hold the blanking level constant with variations in signal content. How this action occurs is demonstrated in Fig. 6. In Fig. 6A a tube has been used which has normal class-A fixed bias and, therefore, the coupling capacitor and grid resistor cause the signal to arrange itself as an average about the bias level causing the blanking levels to change with signal content. Fig. 4B shows the same signals as they appear at the grid of the model 90 video output tube which has no fixed bias (cathode grounded). The bias on this tube is dependent on grid current flow through resistor R_1, Fig. 1. When signal is applied (positive polarity), the tips of the sync pulses draw grid current through R_1 which sets the bias on the tube. Since the sync tip swings just slightly more positive for a signal with a low signal content (high average brightness), more grid current flows and the grid is biased more negatively. Thus, the actual bias on the tube varies with the signal content, while the blanking level which is essentially fixed with relation to the sync tip, remains constant. Since the blanking level grid voltage is fixed, whenever the signal reaches this amplitude, it draws a certain fixed plate current through plate resistor R_2. The voltage drop across R_2 at this plate current is direct-coupled to the picture tube grid, and in conjunction with fixed bias, sets the black-out bias on the tube, Fig. 4B. Thus, if we hold the signal blanking level constant at the grid of the output tube and direct-couple this established level to the picture tube grid, we likewise hold the signal blanking level constant at the grid of the picture tube. This level is made to coincide with the black-out bias level by supplying the correct additional amount of fixed bias to the picture tube control grid.

Fig. 6. Mechanics of d.c. restoration. (A) Signal on grid of video output tube with normal fixed bias. (B) Signal on grid of video output tube used as d.c. restorer (no fixed bias).


FIXED BIAS LEVEL
LOW AVERAGE BRIGHTNESS
BIAS LEVEL CONSTANT
SIGNAL BLANKING LEVELS VARY WITH SIGNAL CONTENT
HIGH AVERAGE BRIGHTNESS
BLANKING CONSTANT
GRID CURRENT FLOW CAUSES TUBE BIAS TO VARY WITH SIGNAL CONTENT, HOLDING SIGNAL BLANKING LEVEL CONSTANT
(A)
(B)

Direct Coupling

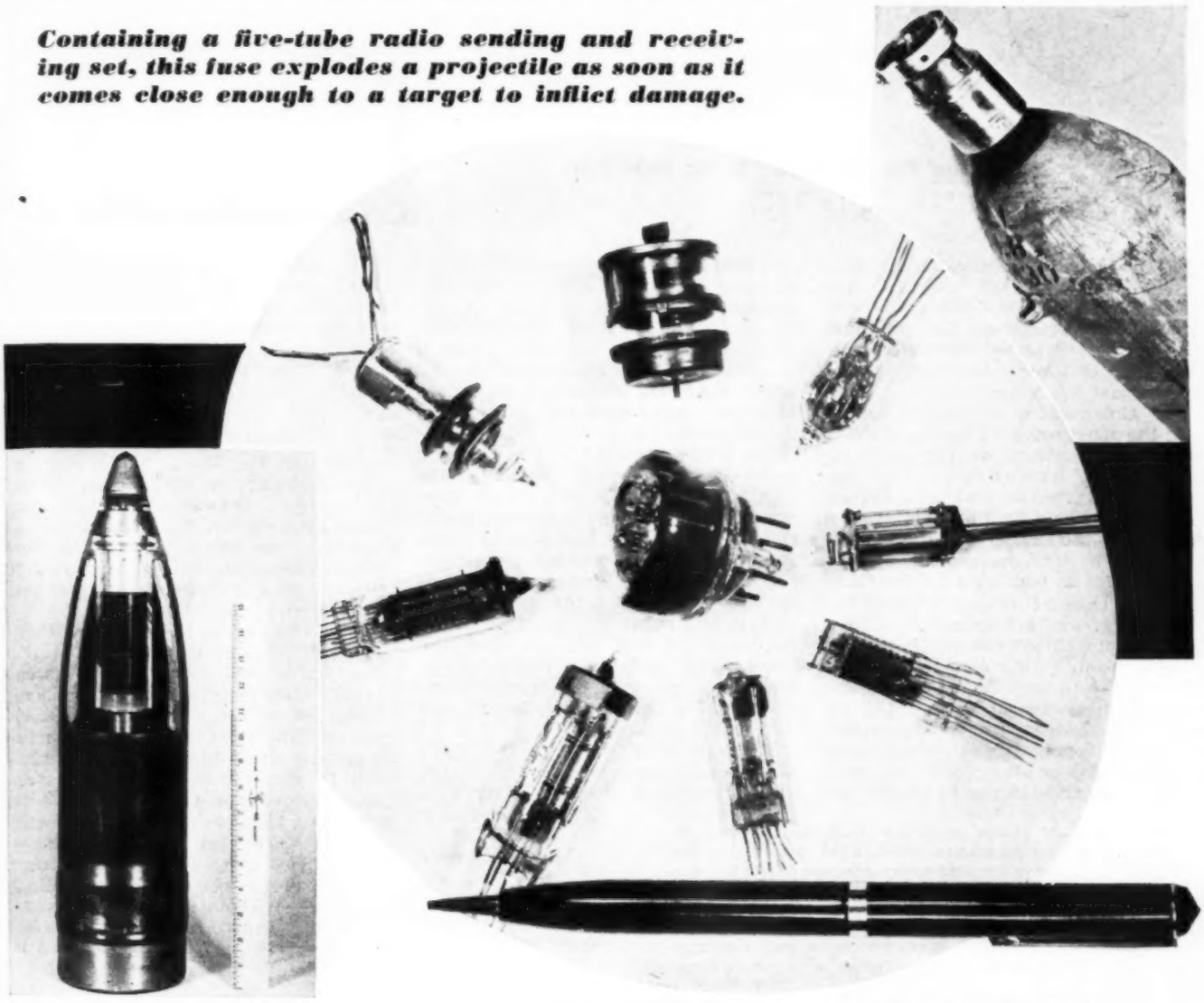
Direct coupling is necessary at this point to prevent the signals from again averaging themselves about a zero axis or bias axis of the picture tube. With direct coupling, Fig. 7, and no applied signal, the bias on the video output tube approaches zero, causing a high current flow and a large voltage drop across resistor R_2. This voltage drop also appears on the grid of the picture tube (for, with direct coupling,

(*Continued on page* 149)

THE PROXIMITY FUSE

Containing a five-tube radio sending and receiving set, this fuse explodes a projectile as soon as it comes close enough to a target to inflict damage.

Variable time fuse shown mounted to the nose of a 500-pound bomb.



Cross-sectional view of a 5-inch projectile shows how an early type fuse is fitted into nose of shell.

Note the rugged construction of these tiny radio tubes which were used in some of the early experimental models of the VT fuse. None of these tubes is much wider than an ordinary pencil.

ONE of the most interesting applications of radio that has come out of wartime developments is the proximity fuse. Although the idea of such a fuse has been in the minds of men for many years, it remained for United States scientists to develop a practical working model through sheer perseverance in the face of seemingly insurmountable obstacles.

In ordnance terms, a fuse is that part of a projectile which detonates the explosive charge. An ideal fuse would detonate the shell at the most favorable position to inflict maximum damage on the target.

Early in the war it became evident that the speed, heights, and maneuverability attained by modern military aircraft presented a method of attack against which fuses currently available for anti-aircraft use were relatively ineffective. Despite the improvements in directing anti-aircraft guns by radar, it was increasingly apparent that the probable number of hits would rapidly diminish as planes improved. What was needed was a shell that would explode only when in proximity to its target and, because of the large numbers that would be required, it was necessary that they could be manufactured by mass-production techniques.

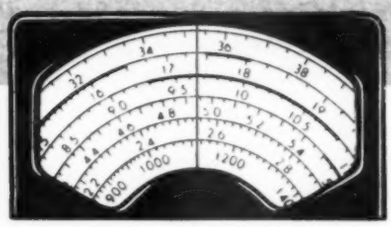
Although inventors had suggested almost every type of proximity fuse in the prewar and war years, none had indicated how the formidable engineering and development difficulties could be overcome. Preliminary tests indicated that the fuses would have to stand accelerations of the nature of 20,000 G's and a centrifugal force exerted by rotation up to 475 per second.

Among the types suggested as having practical possibilities were the photoelectric and acoustic types, along with the radio type. However, as a result of intensive research with all types, it was decided to concentrate on the radio type. Experimental models indicated that this fuse would fulfill the necessary requirements if the essential rugged components could be obtained or developed. It was readily apparent that one of the major stumbling blocks would be the procurement of sufficiently rugged tubes with the small dimensions required, along with the small percentage of failures necessary if the fuse were to be put in large-scale production.

Several of the leading tube companies undertook the development of

(*Continued on page* 154)

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

THE Foreign Broadcast Intelligence Service of the FCC has folded up. The FBIS monitored foreign radio broadcasts and provided the U. S. Government with a principal source of foreign intelligence during the past five years.

The Government originally undertook the monitoring of foreign broadcasts as a result of the expansion of international broadcast facilities which had started several years before the war and was developed even further during the course of the conflict.

During the war, monitoring of foreign broadcasts was used by the Government (1) as a *listening* device to report swiftly and accurately the reaction of foreign governments as expressed through their official or quasi-official radio to any United States informational broadcast abroad and to report the content, trend, and intent of foreign propaganda broadcasts beamed to this or other countries; and (2) as a *collecting* device to report the large volume of intelligence intercepted about conditions and developments in foreign countries, in which capacity the monitoring of foreign radio transmissions represented a source of intelligence which supplemented, and added to, other sources of such data available to the operating agencies of the Government.

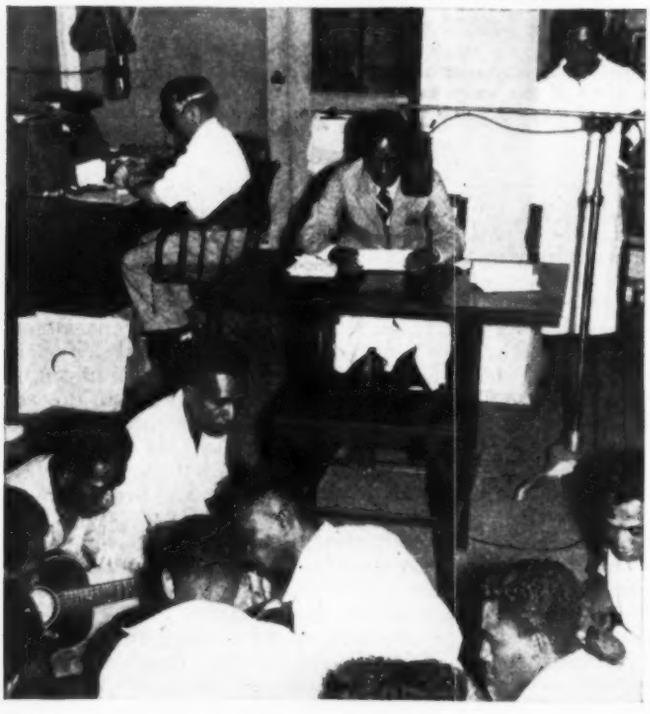
The FBIS operated 24 hours a day, seven days a week. It distributed the significant content from the more than five million words of broadcast material available for monitoring each day. Distribution was by a wire circuit to all principal government offices in Washington and through various reports and publications. The principal users of this service were the State, War, and Navy Departments, Foreign Economic Administration, UNRRA, Federal Reserve Board, and the Justice Department.

Field listening posts of the FBIS were located at Iwo Jima, Guam, Kauai; Portland, Oregon; Silver Hill, Maryland; London; and Cairo.

On September 27, the FCC announced that the FBIS was "slated to go out of existence within 30 days", with thirty-day furlough notices having been issued to the more than 350 employees of FBIS as a result of action by the House Appropriations Committee, which recommended that $930,000 be cut from the FCC's National Defense Appropriation for the current fiscal year. FBIS was maintained during the war years on an annual budget of approximately $1,500,000.

It is believed possible that the FCC will retain someone from the FBIS staff to continue the compilation and release of short-wave reception notes, station lists, and occasional detailed program schedules of the important short-wave broadcasters. Such a service would be of much benefit to short-wave listeners both here and abroad.

This interesting picture from the South Seas shows the studio of short-wave station VPD2, 6.135 mcs., Suva, Fiji, during the Tuesday evening native program (heard 3-4 a.m. EST). These sessions are most popular and have an enthusiastic audience of many thousands, VPD2 reports. This station is heard throughout the U. S. and Canada, particularly on Sundays, 1-5 a.m. EST, when English is used regularly.



* * *

NORWAY CALLING

Through the Royal Norwegian Information Service, 3516 Massachusetts Ave., N. W., Washington 7, D. C., we have received the following information from the Radio Office of the Norwegian Communications Authority in Oslo relative to short-wave broadcasts from Norway:

"The Norwegian Broadcasting Company at the present time has one short-wave transmitter in action; namely Oslo Short-wave; power 5 kw.; signature, LKJ; frequency, 9.540; wavelength, 31.45 meters. Transmission times are 1-1:15 a.m., 4:20-7 a.m., and 10 a.m.-4 p.m. News transmissions are scheduled for 1 a.m., 6 a.m., 12 noon, and 3 p.m. The station broadcasts in Norwegian except for the period, 6:30-7 a.m., when, for the time being, a program is broadcast in English for the Allied forces in Norway."

Carl L. Horton, Athol, Massachusetts, reports LKJ, 9.540, as heard in Norwegian, 10:45 a.m.-4 p.m., Q4-R8.

* * *

VERIFICATION LISTS

Of some fifty short-wave stations verified (including some prewar ones now extinct), Charles Black, York, Pennsylvania, writes that he prizes most, verifications from Radio Saigon, Mozambique, DIQ (Germany); 20-meter amateurs K7HAR (Alaska), EA7BA (Spain); and 10-meter amateur KB4HBX (Virgin Islands).

Countries verified by Mr. Black include Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Ecuador, Ireland, France, French Equatorial Africa, French Indo-China, Germany, Guatemala, Haiti, Holland, Hungary, Italy, Jamaica, Mozabique, Panama, Portugal, Suriname, Sweden, Spain, Switzerland, and Venezuela.

Bill Milne, Invercargill, New Zealand, reports 89 short-wave verifications and 180 on the BCB. Recent verifications on short-wave include KGEI, CHTA, WWV, GSW, WLWK, WLWL and WLWR.

(*Continued on page* 100)

AROUND THE CLOCK WITH SHORTWAVE BROADCASTS

EST	LOCATION	CALL	FREQ.*
7:00 a.m.	Tokyo (Relays AFRS)	JLP	9.605
7:00 a.m.	Honolulu	KRHO	6.120
7:00 a.m.	Calcutta	VUC2	4.840
7:00 a.m.	Delhi	VUD4	9.590
		VUD10	9.670
7:15 a.m.	Macao, Portuguese China	Radio Macao	7.530
7:15 a.m.	Brazzaville	FZI	17.530
7:20 a.m. (Sat. only)	Petropavlovsk, USRR		6.070
7:20 a.m.	Moscow		6.800
			9.560
			11.630
			11.830
			15.750
7:30 a.m.	Colombo, Ceylon	ZOJ	11.810
7:30 a.m.	Melbourne	VLG4	11.840
		VLC6	9.615
7:45 a.m.	Sackville, N.B.	CHTA	15.220
7:45 a.m.	London	GVY	11.955
8:00 a.m.	Melbourne (Shepparton)	VLC5	9.540
8:00 a.m.	Honolulu	KRHO	6.120
8:00 a.m.	Tokyo (Relays AFRS)	JLP	9.605
8:00 a.m.	Hongkong	ZBW	9.495
8:00 a.m.	London	GWC	15.070
		GSK	26.100
		GSP	15.310
		GWC	15.070
		GRG	11.680
		GSV	17.810
		GSJ	21.530
		GWR	15.300
		GSO	15.180
		GRF	12.090
		GSD	11.750
		GVO	18.080
		GVQ	17.730
		GRA	17.710
8:00 a.m.	Perth	VLW7	9.520
8:00 a.m.	Delhi	VUD6	7.210
8:00 a.m.	Brisbane	VLQ2	7.215
8:20 a.m.	Shanghai	XGOO	11.690
8:30 a.m.	Singapore		7.220
			11.858
8:30 a.m.	Delhi	VUD2	7.290
		VUD4	9.590
		VUD7/10	11.760
		VUD5	11.790
		VUD6	9.636
		VUD7/10	15.160
8:45 a.m. (or 9 a.m.)	Rangoon, Burma		6.040
9:00 a.m.	Chungking	XGOY	7.152
			9.810
		XGOA	9.730
	(Via Kweichow, Kweiyang)	XPSA	7.010
	(Via Peiping)	XGAP	6.103
9:00 a.m.	Honolulu	KRHO	6.120
9:00 a.m.	London (RN)	GRA	17.710
		GRY	9.600
		GRG	11.680
		GSV	17.810
		GSF	15.140
		GSD	11.750
		GVQ	17.730
		GVO	18.080
9:00 a.m.	Delhi	VUD6	7.210
9:00 a.m.	Melbourne	VLC6	9.615
		VLA	7.280
9:15 a.m.	Belgrade	YUC	9.505
9:15 a.m.	Melbourne	VLA	7.280
		VLC6	9.615
9:30 a.m.	Moscow		12.080
9:30 a.m.	British Somaliland (Relays BBC)	Radio Somali	7.125
9:30 a.m.	Singapore		7.220
9:30 a.m.	Colombo, Ceylon	ZOJ	11.810
9:30 a.m.	Leopoldville	RNB	15.170
9:35 a.m.	Rangoon, Burma		11.860
9:35 a.m.	Melbourne (Shepparton)	VLA	7.280
		VLC6	9.615
9:50 a.m.	Bombay	VUB2	7.240
9:50 a.m.	Delhi	VUD3	7.295
		VUD6	9.635
		VUD5	7.275
		VUD7	6.190
10:00 a.m.	Jerusalem	JCKW	7.220
10:00 a.m.	Stockholm	SBT	15.155
10:00 a.m.	Delhi	VUD6	7.210
		VUD6	9.635
		VUD5	7.275
		VUD7	6.190
		VUD3	7.295
10:00 a.m.	London	GVY	11.955
		GWE	15.435
		GSF	15.140
		GVX	11.930
		GWR	15.300
		GSO	15.180
		GRF	12.090
		GSD	11.750
		GSV	17.810
		GVO	18.080
		GVQ	17.730
		GSP	15.310
		GRG	11.680
		GRY	9.600
		GRH	17.710
		GSH	21.470
10:00 a.m.	Perth	VLW7	9.520
10:00 a.m.	Sackville, N.B.	CHTA	15.220
10:15 a.m.	Melbourne	VLA	7.280
		VLC2	9.680
		VLR3	11.880
10:30 a.m.	Cairo	SUZ	13.825
10:45 a.m.	Leopoldville	RNB	9.745
11:00 a.m.	Baghdad, Iraq (Relays BBC)	Y15KG	7.085
11:00 a.m.	London	GRY	9.600
		GSP	15.310
		GRD	15.450
		GRP	17.870
		GSD	11.750
		GSI	15.260
		GVW	11.700
		GRF	12.090
		GSG	17.790
		GVW	11.700
11:00 a.m.	Melbourne	VLG4	11.840
		VLC6	9.615
11:00 a.m.	Moscow		11.830
			15.750
11:00 a.m.	Addis Ababa, Ethiopia (Relays BBC)		4.965
			9.617
11:10 a.m.	Chungking	XGOY	9.810
			7.152
11:15 a.m.	Ankara	TAP	9.465
11:30 a.m.	British Somaliland	Radio Somali	7.125
11:30 a.m.	Cairo	JCPA	7.190
11:30 a.m.	Colombo, Ceylon	ZOJ	11.810
11:35 a.m.	Melbourne	VLG4	11.840
		VLC6	9.615
11:45 a.m.	Ankara	TAP	9.465
12:00 noon	London	GSP	15.310
		GSD	11.750
		GRF	12.090
		GSG	17.790
		GVO	18.080
		GVQ	17.730
		GVX	11.930
		GRG	11.680
		GWR	15.300
		GSO	15.180
		GRD	15.450
12:00 noon (irreg.)	Moscow		15.750
12:00 noon	British Somaliland	Radio Somali	7.125
12:30 p.m.	Omdurman, Anglo Egyptian Sudan	Radio Omdurman	13.315
12:40 p.m.	Stockholm	SDB2	10.780
		SBT	15.155
12:45 p.m.	Athlone, Ireland	Radio Eirrean	17.840
12:45 p.m.	Sackville, N.B.	CHTA	15.220
1:00 p.m.	Cairo	SUZ	13.825
1:00 p.m. (irreg.)	Moscow		15.750
1:00 p.m.	London	GSI	15.260
		GVW	11.700
		GRY	9.600
		GVY	11.955
		GSN	11.820
1:00 p.m.	Accra, Gold Coast	ZOY	7.050
1:00 p.m.	Sackville, N.B.	CHTA	15.220
1:00 p.m.	Teheran, Iran	EQC	9.680
1:30 p.m. (Sun. only)	Moscow		11.830
1:30 p.m.	Dakar, Fr. West Africa	FGA	7.210
1:30 p.m.	Winnipeg	CKRX	11.720
1:30 p.m. (or 1:40 p.m.)	Teheran, Iran	EQC	9.680
1:45 p.m.	Sackville, N.B.	CHTA	15.220
1:45 p.m.	Brazzaville	FZI	9.440
			17.530
2:00 p.m.	Jerusalem	JCKW	7.220
2:00 p.m.	Cairo	JCPA	7.190
2:00 p.m.	London	GWR	15.300
		GRG	11.680
		GSB	9.510
		GSO	15.180
		GRS	7.070
		GSD	11.750
		GRU	9.910
		GRD	15.450
		GSG	17.790
		GVQ	17.730
2:05 p.m.	Lourenco Marques, Mozambique	CR7BE	9.710
2:20 p.m. (except Sat.)	Bern	HEK5	15.875
2:30 p.m.	London (RN)	GVW	11.700
		GRY	9.600
		GVY	11.955
		GSN	11.820
		GSI	15.260
3:00 p.m.	Prague	OLR3A	9.550
3:00 p.m.	Milan (Relays AFRS)	AFRS	6.135
3:00 p.m.	Madrid	Radio Nacional de Espana	9.370
3:00 p.m.	London	GSB	9.510
		GRS	7.070
		GSD	11.750
		GRU	9.910
		GWR	15.300
3:30 p.m.	Lublin, Poland	Radio Polskie	6.115
3:30 p.m. (Mon., Thurs.)	Ankara	TAP	9.465
3:45 p.m.	Cairo	SUX	7.860
3:45 p.m.	Brazzaville	FZI	9.440
			17.530
3:45 p.m.	London	GVW	11.700
		GVY	11.955
		GRY	9.600
		GSN	11.820
		GSI	15.260
4:00 p.m.	Honolulu	KRHO	17.800
4:00 p.m.	Beirut, Lebanon	FXE	8.020
4:00 p.m.	Milan (Relays AFRS)	AFRS	6.135
4:10 p.m.	Athlone, Ireland	Radio Eirrean	9.595
4:45 p.m.	Sackville, N.B.	CHOL	11.720
4:45 p.m.	London	GSP	15.310
		GRG	11.680
		GVZ	9.640
		GRH	9.825
		GSU	7.260
5:00 p.m.	Quito (Relays San Francisco)	HCJB	12.455
			15.100
			9.960
5:15 p.m.	Sydney, N.S.	CJCX	6.010
5:15 p.m.	Brazzaville	FZI	9.440
			11.970
5:30 p.m.	Halifax, N.S.	CHNS	6.130
5:45 p.m.	London	GRG	11.680
		GVZ	9.640
		GRH	9.825
		GSU	7.260
		GSD	11.750
		GSB	9.510
		GSC	9.580
	(Via St. Johns Newfoundland)	VONH	5.970
	(Via Kingston, Jamaica)	ZQI	4.700
	(Via Georgetown, British Guiana)	ZFY	6.000
5:47 p.m.	Moscow		7.030
			11.830
			15.750
	(Via Komsomolsk)		15.230
	(Via Leningrad)		9.715
6:00 p.m.	Sackville, N.B.	CHOL	11.720
6:00 p.m.	Sydney, N.S.	CJCX	6.010
6:00 p.m.	Honolulu	KRHO	17.800
6:15 p.m. (Tue., Sat.)	Fort-de-France, Martinique		9.705
6:15 p.m.	Moscow		7.400
			7.030
			11.830
			15.750
	(Via Komsomolsk)		15.230
	(Via Leningrad)		9.715
6:15 p.m.	Winnipeg	CKRX	11.720
6:30 p.m.	Brazzaville	FZI	9.440
			11.970
6:45 p.m.	London	GSU	7.260
		GVZ	9.640
		GRH	9.825
		GRG	11.680
	(Via Georgetown, British Guiana)	ZFY	6.000
7:00 p.m.	Honolulu	KRHO	17.800
7:15 p.m.	Leopoldville	RNB	9.745
7:15 p.m.	Lahti, Finland	OIX2	9.502
		OIX3	11.780

(*Continued on page* 118)

(* Frequencies shown are in megacycles. To convert to meters divide 300 by the frequency in megacycles or 300,000 by the frequency in kilocycles.)

FM RADIO RELAY

U. S. Army Signal Corps operators monitor a radio relay signal. Being extremely portable, this equipment was used extensively behind many of our battle lines.

Although designed for military purposes, this equipment can be used for peacetime operation as a connecting link between remote or isolated areas and existing telephone lines.

By
J. M. LEE

WITH a tough and flexible telephonic-radio communications system, popularly dubbed *leap frog* by the Army, long-range military communications have been improved to a degree heretofore unknown. The system became invaluable to the Signal Corps in its job of installing, operating, and maintaining the vast communications networks over which flowed the thousands of messages that kept our fighting armies functioning.

Radio relay was used as a standby for open wire and other wire circuits already in operation; it gave HQ direct telephone communication facilities with armies in the field. With it, for instance, General MacArthur could pick up a telephone at his headquarters and talk directly with divisional generals fighting in a jungle valley two hundred miles away.

The Signal Corps' radio relay equipment is just what its name implies. It is an easily portable combination of radio and wire terminal equipment designed to be used as a link in telephone wire systems. When wire lines are connected directly to the radio relay units, radio signals may be relayed a distance of up to two hundred miles. For two-way communication, a receiver and transmitter are placed at each terminal, with a separate radio frequency for each direction. At each relay station, two sets of receivers and transmitters are required, and a new pair of frequencies is assigned to each leg of the relay.

The radio relay system has been widely used in all Allied war theaters, but until recently it has been one of the most secret radio developments of the war. The system was developed by the *Coles Signal Laboratory* of the Signal Corps Engineering Laboratories with *Link Radio Corporation* of New York. The equipment is presently manufactured by *Lear, Incorporated,* in their radio plant at Grand Rapids, Michigan.

Until the all-out campaign to wrest the Philippines from the Japs, the radio relay was used to cover relatively short distances only. Perhaps the longest distance covered for a military operation, prior to Luzon, was across the English Channel and far into France after D-day. In a matter of hours after our troops had opened the second front in France, this system of telephonic-radio communications was set up to link our operations with England. From then on, as our advances were made throughout the entire European campaign, the radio relay system enabled us to maintain radio contact with English stations.

A heroic instance of radio relay's importance in the ETO was at the time General Anthony McAuliffe's 101st Division was completely surrounded at Bastogne. With all wire communications cut off, McAuliffe, using the radio relay, was able to maintain constant intelligence traffic with outside corps' headquarters, a leading factor in the ultimate success of his drive through.

With increased experience in its use, and continual manufacturing improvements, the radio relay system hit its all-time peak in the Philippine campaign. On Leyte, fully ninety per-cent of our field communications were made up of this radio equipment. When used (as one of its phases) by radio broadcasters and commentators inland to broadcast to a studio on a ship offshore, the reception quality

was so good that correspondents on Tacloban airstrip, interviewing troops on the field, were able to radio these talks directly to the United States.

By experimenting with great heights of antennas, our men at Luzon found that telephone communications could be maintained at distances as great as seventy-five miles between radio stations. This meant that, with telephones at San Miguel and at Manila, there could be direct speaking communications without wires. Later, by using proper antenna heights, Signal Corps men were able to obtain even better results by by-passing some radio relays in between points, and communicating directly over the wider-spaced jumps.

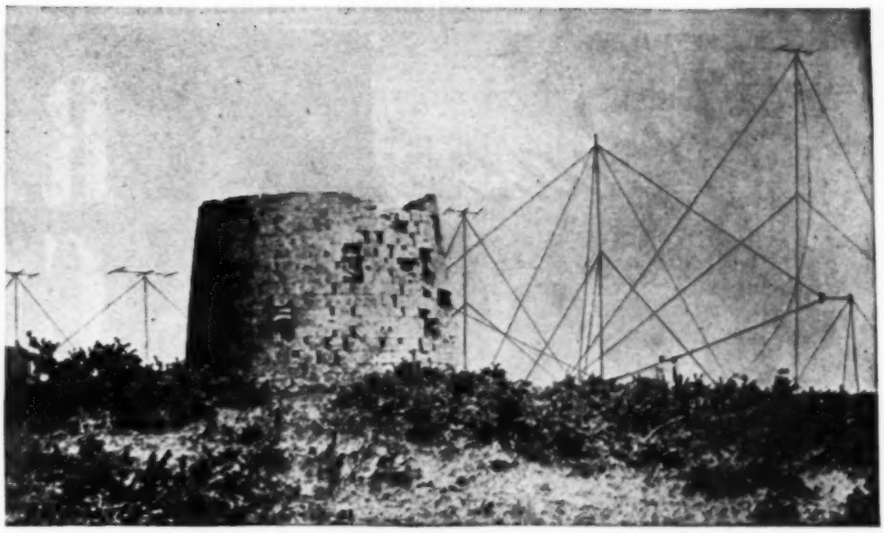
The most dramatic use of the radio relay system, to date, came early in March, immediately upon the entrance of our troops in Manila. General MacArthur, speaking from the Crystal Room of the Malacannan Palace, announced that Manila was again in American hands. The historic speech was picked up by telephone, relayed by the system to the nearest broadcasting studio (in this case, the studio was on a ship lying offshore in Lingayen Gulf one hundred miles away), and thence broadcast throughout the world.

Besides its unusual feats of communications, the equipment is well adapted to the hazards of combat operation. When a Jap bomb hit the system on Biak, knocking down the antennas and breaking the director arrays and coaxial cables, imperturbable Signal Corps technicians put it back in working order within an hour. All this was done despite the critical tuning involved in operating the system.

Thus, it can be seen that the military advantages of the radio relay system are tremendous. Rather than have to take, hold, and constantly patrol hundreds of miles of territory through which wire lines are run, a radio relay station can be set up and maintained in a small area of an acre or so —and provide the equivalent of *four* ordinary telephone channels for distances of twenty-five to one hundred miles in each direction. Accessibility or military vulnerability of intervening terrain need never be seriously considered. Large bodies of water, for example, no longer are a serious obstacle in the communications network.

The equipment features complete communications systems ready to install in a few hours. It is compact and portable. In addition to transmitting and receiving sets, carrier telephone and telegraph terminal equipment, and ringers, it includes antenna systems, spare parts, tools, rope, tape—everything required to set up and operate in any location, whether makeshift or permanent.

The entire assemblage of equipment necessary to maintain a radio terminal station on 24-hour service is included in Radio Terminal Set AN/TRC-3. The same equipment, plus the additional receiving, transmitting, antenna, and power supply components needed to maintain a two-way repeater station, is supplied in the Radio Relay Set AN/TRC-4.



Terminal set AN/TRC-4 which operated as a radio relay station in the first U. S. Army Signal Corps cross-channel circuit.

A frequency range of 70 to 100 mc. is covered by each set. Within this range, it has a nominal power output of 50 watts on any one pre-set crystal controlled frequency. Power output can be lowered to less than 10 watts by a panel switch, with an increase up to approximately 250 watts by an auxiliary power amplifier (Amplifier Equipment AN/TRA-1).

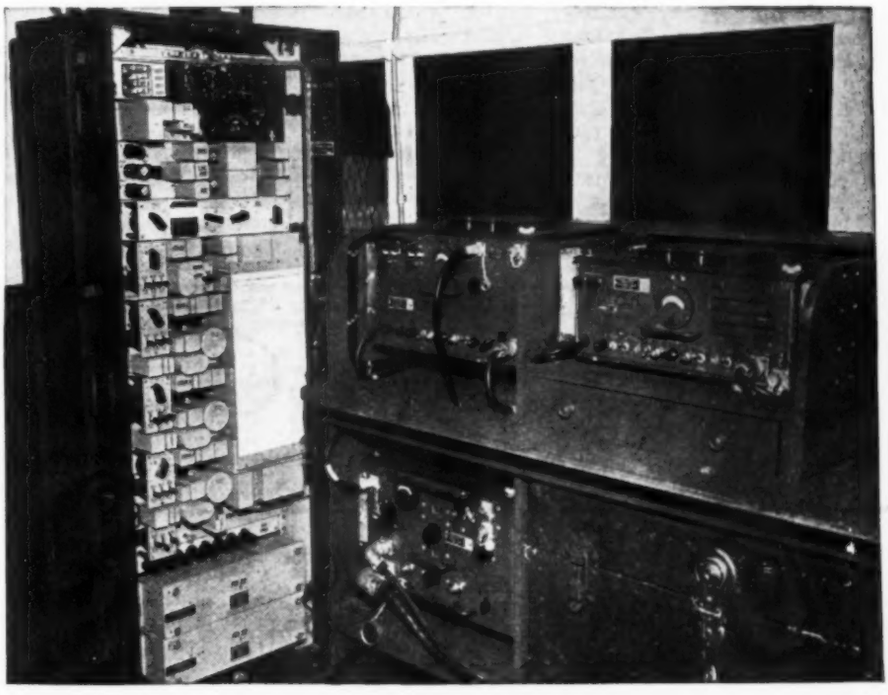
The equipment may be used in a multi- or single-channel radio relay circuit, and as a terminal or repeater station. It is coupled to spiral-four cable when used in multi-channel carrier telephone-radio relay circuits. It may be fed from regular commercial power or by a standard Signal Corps gasoline engine driven alternator, which is furnished with the equipment.

The 11-tube radio *transmitter* has a basic crystal frequency range of 729.167 kc. to 1041.667 kc. and a 9 kc. peak deviation for each of its four carrier telephone channels, and an audio input level to the modulator of -12 db. Input impedance in the high fidelity circuit is 500 ohms; in the microphone circuit, 30 to 50 ohms. The audio frequency response is substantially flat from 250 to 12,000 c.p.s.

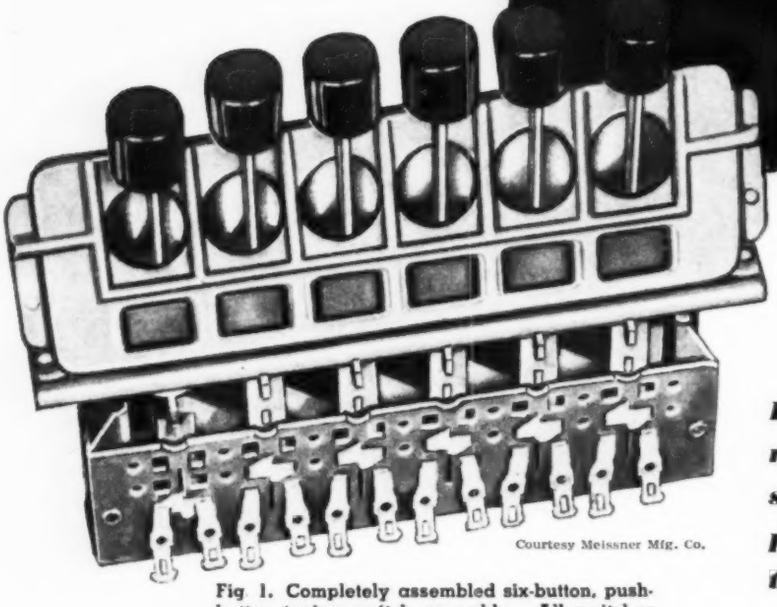
The frequency-modulated transmitter utilizes the phase-shift method of obtaining frequency deviations. Intelligence is conveyed by variations of the constant-amplitude carrier frequency about a mean value. This contrasts in amplitude modulation to the intelligence being contained in amplitude variations of the constant fre-

(*Continued on page* 151)

Radio relay and associated carrier equipment in mobile truck.



Practical RADIO COURSE



Courtesy Meissner Mfg. Co.

Fig 1. Completely assembled six-button, push-button tuning switch assembly. All switches in the unit have sliding contact motion.

By
ALFRED A. GHIRARDI

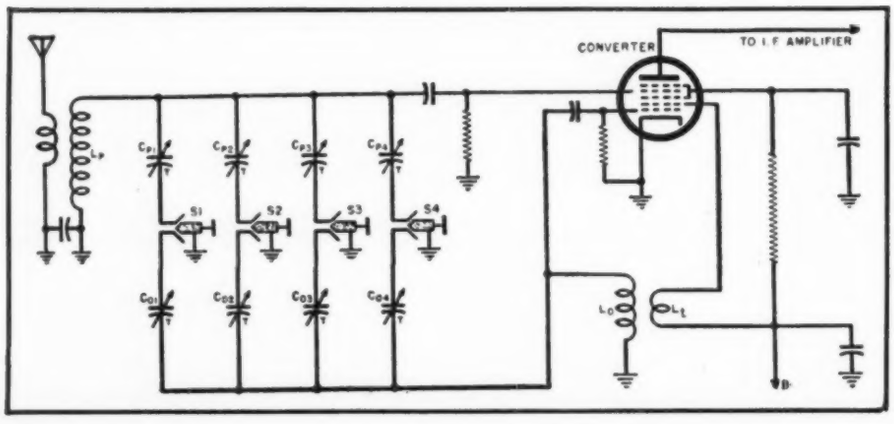
Part 39. A review of the various automatic (push-button) station selector systems and the special oscillator-preselector tracking problems that arise when they are used.

RECEIVERS that incorporate provisions for rapid selection of stations, or changeover from one station to another, by simple operation of interlocked push-button switches, levers, telephone-type dials, etc., have received popular acceptance and are in widespread use. They are popularly known as *automatic tuned,* or *push-button tuned,* receivers. In all of them, preliminary settings or adjustments of the receiver tuning system are made so that a particular station is received for each automatic tuning control position (push-button, lever, etc.). Thereafter, every time that given button, lever, etc., is operated, the original setting is reestablished and that particular station is received. The majority of multi-band receivers that employ such automatic station selection incorporate it on the standard broadcast band only; tuning on the short-wave bands is still done manually by means of the conventional manually operated ganged tuning capacitor. In fact, many of the home and auto-radio type receivers that provide push-button tuning to 5 or 6 stations on the broadcast band, also make provision for optional manual tuning on this band. A typical push-button tuning switch assembly is illustrated in Fig. 1.

A variety of methods and circuit arrangements have been developed for accomplishing automatic station selection. While a superficial examination of all of them would make the subject seem bewilderingly complex, a systematic study will reveal that the various systems used are interrelated and can be easily classified; also, certain devices, circuit elements, and circuit arrangements are common to many of them.

The study of automatic station selector systems can be greatly simplified by classifying them into *three* distinct types according to the basic operating principle employed in each. Then the operating features of each type, as well as the various tuning circuit arrangements employed with each, may be studied separately and in detail.

Fig. 2. Simple push-button tuning arrangement employing pre-set substitution capacitors (C_{p1-4}, C_{o1-4}) for tuning both the preselector and oscillator circuits.



General Types of Automatic Station Selector Systems

The three general types are:

(1) Those in which an electric motor or an electric solenoid system drives the rotor of the conventional gang tuning capacitor to a predetermined position corresponding to its tuning position for the station to which the particular push button has been assigned.

(2) Those in which the direct effort of the person operating the receiver is applied through mechanical devices (such as levers and cams) to drive the rotor of the conventional gang tuning capacitor to this predetermined position.

(3) Those in which the conventional fixed coil—variable gang tuning capacitor tuning system is replaced by a series of individually preset tuned

circuits, each being correctly tuned for reception of the particular station to which it has been assigned. These circuits are selected either directly by push-button switches, or by push-button switches that control solenoid-operated selector switches.

Any of these three types can be activated by different devices, such as levers, telephone dials, or push-buttons. All have been employed, but the push-button appears to be the most popular because it results in a simple, straightforward arrangement for even the most mechanically unskilled person to operate.

System Types (1) and (2)

Since all automatic tuning systems of these two types employ the conventional ganged variable tuning capacitor for simultaneously tuning the preselector and oscillator circuits of the receiver, no special tuning circuits or tracking problems are encountered in receivers in which they are used. Either the cut-plate[1] or the series-padder[2] method of tracking the oscillator frequency at a constant frequency-difference above that of the preselector circuits is employed, and is entirely satisfactory. The latter method, because of its important advantages, now is the one most used. Accordingly, these two systems of automatic tuning will not be further discussed here.

Pre-Set Trimmer, or Tuned-Circuit Substitution Type, Automatic Tuning System

The third type usually is referred to as the pre-set trimmer or tuned circuit substitution type of automatic station selection. The usual variable gang tuning capacitor and fixed preselector and oscillator tuning coil arrangement are not used for the automatic tuning. Substituted for them is one of the following tuning arrangements—all widely used:

(A) A series of interlocking, ganged push-button switches and semi-fixed trimmer-type capacitors so arranged that by pressing any one button, an adjustable trimmer capacitor of preset capacitance is switched across the single fixed preselector tuning coil, and another is simultaneously switched across the fixed oscillator tuning coil. This tunes both circuits to the proper frequencies for reception of the signal of the particular station to which that button has been assigned and for which the adjustable trimmer capacitors have previously been adjusted. This basic arrangement is illustrated in Fig. 2 for a simple broadcast-band, push-button receiver employing a single tuned preselector circuit. L_p and L_o are the fixed preselector and oscillator tuning coils respectively. L_t is

[1] For a discussion of the cut-plate method of oscillator—preselector tracking see Part 36 of this series in the August 1945 issue of RADIO NEWS.

[2] For a discussion of the series-padder method see Parts 37 and 38 of this series in the September 1945 and October 1945 issues of RADIO NEWS.

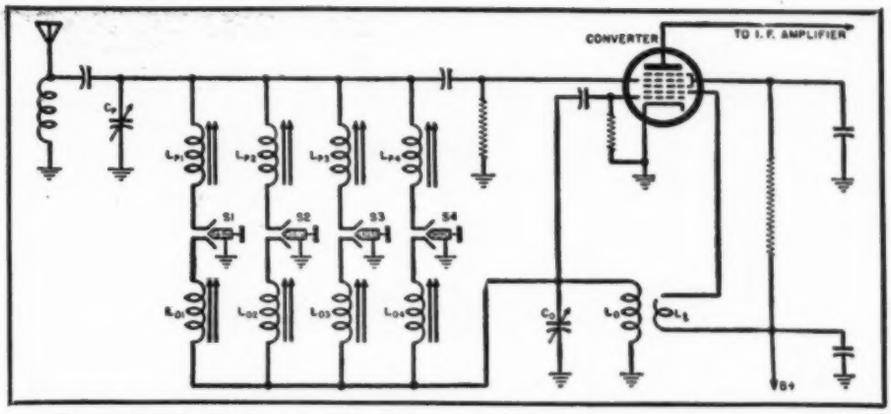


Fig. 3. Simple push-button tuning arrangement employing preset iron-core substitution inductors (L_{p1-4}, L_{o1-4}) for tuning both the preselector and oscillator circuits.

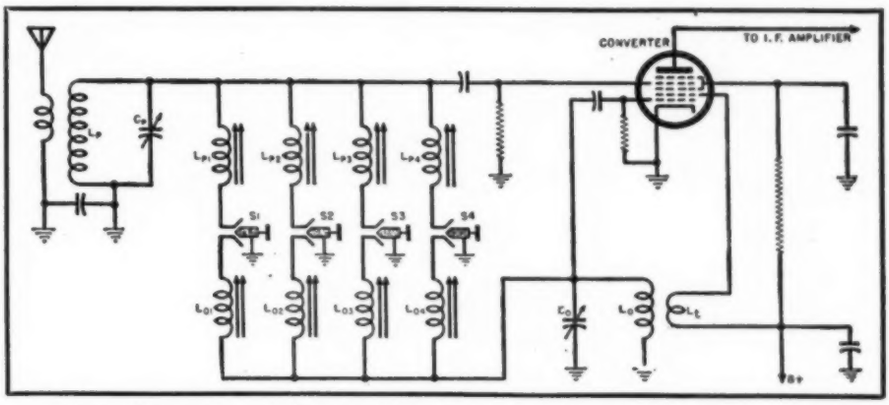


Fig. 4. Here each push-button switch shunts preset iron-core inductors across the fixed inductor and capacitor combinations L_pC_p and L_oC_o that already tune the preselector and oscillator circuits to a frequency above the broadcast band.

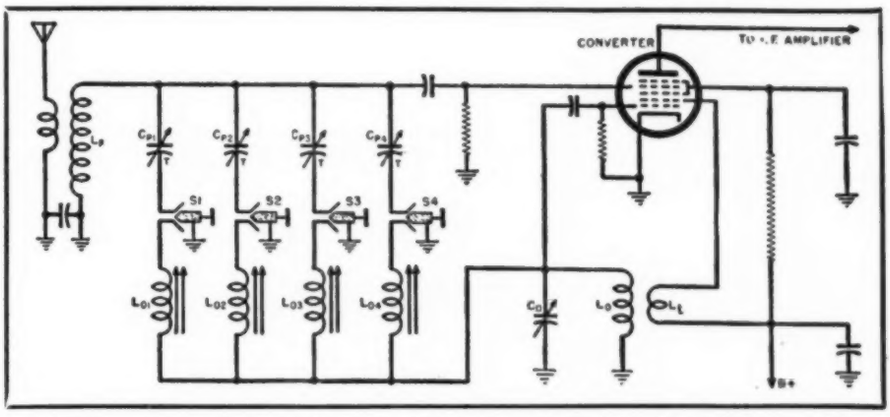
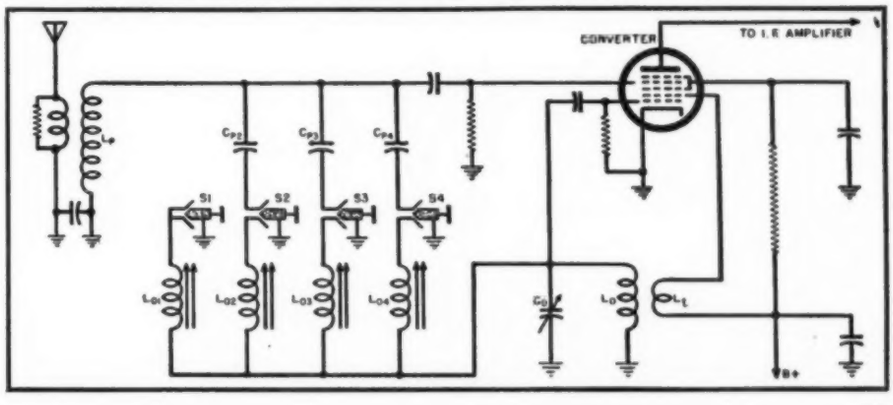


Fig. 5. Here capacitor-substitution tuning is employed in the preselector circuit and inductor-substitution tuning is employed in the oscillator circuit.

Fig. 6. Here the input circuit is fixed-tuned to the range of each button by means of fixed mica capacitors. The oscillator is tuned by pre-set iron core inductors.



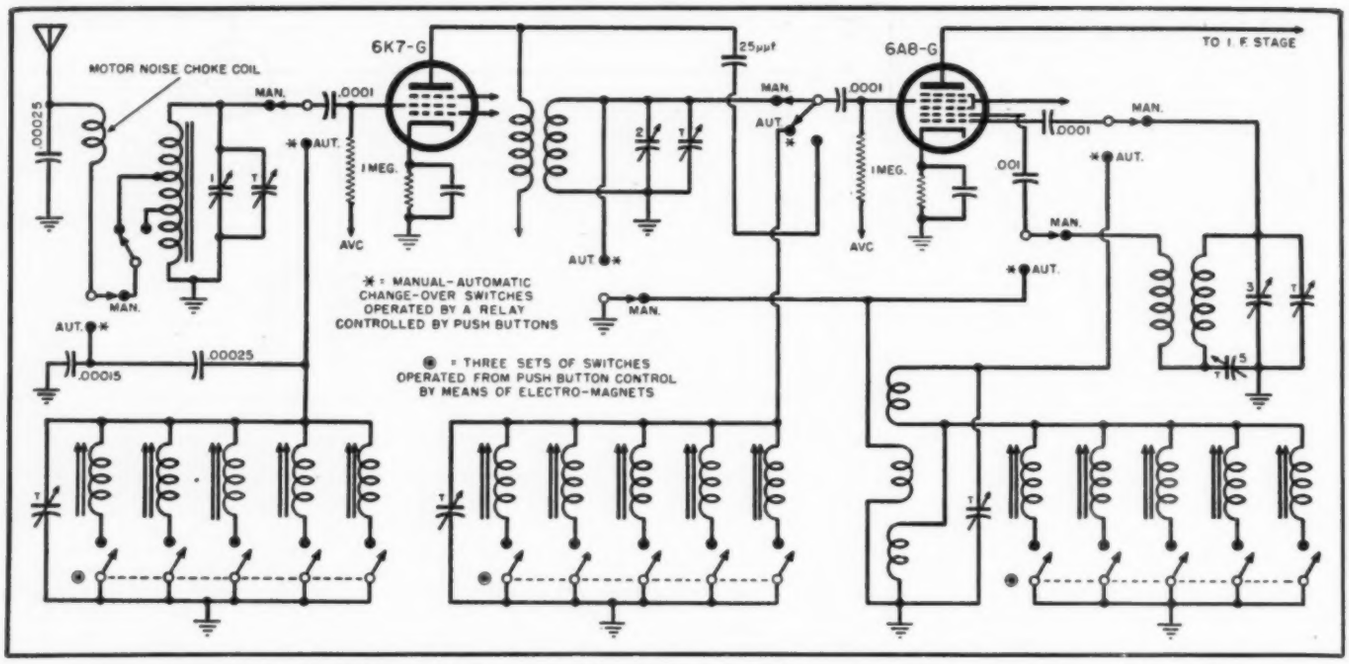


Fig. 7. Tuner of Zenith 6M295 push-button auto-radio receiver, in which two preselector tuned circuits and the oscillator tuned circuit employ iron-core inductors switched in and out of the circuit by electromagnetic-operated switches.

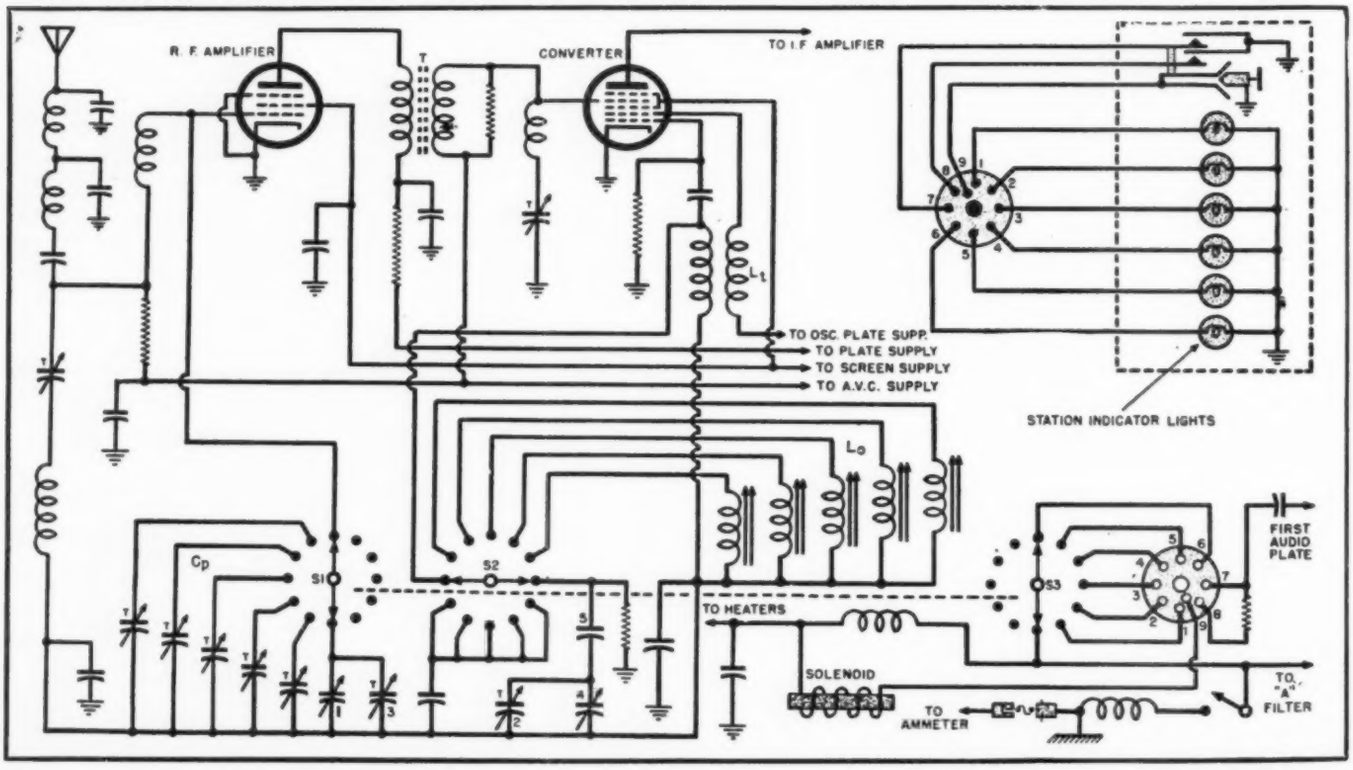
the tickler coil connected in the oscillator plate circuit of the converter tube. Four push-button switches S_1, S_2, S_3, S_4 are provided for selection of the proper pair of adjustable pre-set preselector and oscillator tuning capacitors (C_p and C_o) for tuning to any one of four different stations.

(B) An arrangement somewhat similar to that of *A*, except that each push-button switch shunts an iron-core inductor of pre-set inductance across a fixed (or adjustable) capacitor in the preselector circuits, and another across a fixed capacitor in the oscillator tuning circuit. This is illustrated in Fig. 3, where C_p and C_o are the fixed preselector and oscillator tuning capacitors, respectively. Coil L_o serves to couple the oscillator grid circuit to the oscillator plate tickler L_t.

(C) An arrangement similar to that of *B* except that each push-button switch shunts iron-core inductors of pre-set inductance values across fixed inductor and capacitor combinations L_pC_p and L_oC_o that already tune the preselector and oscillator circuits to frequencies *above* the broadcast-band. The inductance added by the push-button switching serves to tune the entire combination *down* for station reception at that broadcast-band frequency to which the particular button is assigned. This arrangement is illustrated in Fig. 4.

(D) An arrangement which is a combination of *A* and *B*. In this, each

Fig. 8. Push-button tuner system employing a solenoid-operated ganged rotary selector switch for switching the various trimmers and iron-core inductors into the preselector and oscillator tuning systems for station selection. (Firestone S7407-5 auto-radio receiver.)



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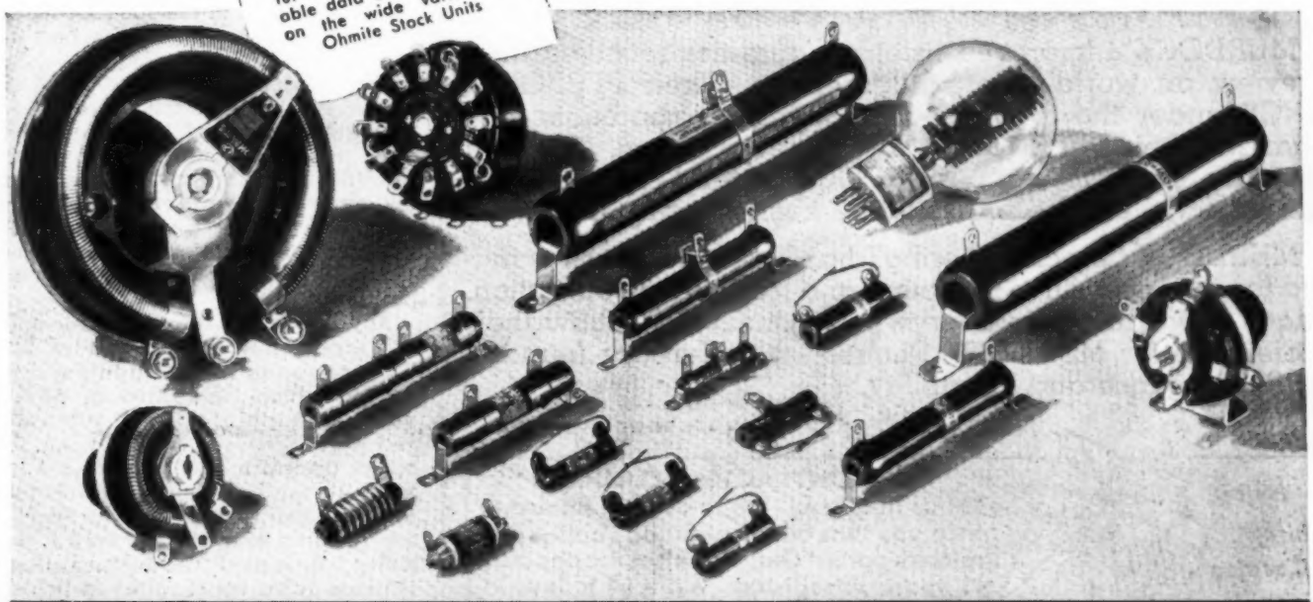

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push-button switches a pre-set trimmer capacitor across the fixed preselector tuning coil, and a pre-set iron-core inductor across a fixed capacitor (or a fixed-capacitor and fixed-inductor combination) in the oscillator tuning circuit. This is illustrated in Fig. 5.

(E) An arrangement in which the signal input circuit associated with each button is broadly fixed-tuned to the midpoint of the narrow signal-frequency range that button is assigned to, by means of fixed mica capacitors of various selected values, and only the oscillator is accurately tuned for reception of the desired station by means of a pre-set, iron-core inductor switched into the oscillator circuit. This is illustrated in Fig. 6. The input circuit will be roughly in tune for any station within the assigned frequency range of the button. No fixed capacitor is used with the highest-frequency push-button switch S_1 because the antenna coil is resonant to this frequency range by virtue of the distributed capacitance of the coil and stray capacitance of the circuit wiring. To set up stations on this and similar type tuners, adjustment of only one tuned circuit is required for each button—that of the oscillator inductor. In one line of commercial receivers (the *Emerson Miracle Tuner* receiver series) an arrangement somewhat similar to this was used, excepting that a series of pre-set trimmer capacitors instead of the iron-core inductors shown here were used to tune the oscillator.

(F) An arrangement involving the use of but *one* push-button switch controlling a solenoid-operated ratchet driving a ganged rotary selector switch, as illustrated in Fig. 8. Each time the push-button is pressed, current flows through the solenoid which, in turn, activates a plunger that operates a ratchet mechanism. Each time the solenoid is energized and the ratchet operates, it advances the rotary selector switch by one position, each position being wired to switch into the preselector and oscillator tuning circuits the proper pre-set trimmer capacitors or iron-core inductors required for reception of the particular station corresponding to that switch position.

Any of the pre-set substitution-circuit arrangements shown in Figs. 2, 3, 4, 5, or 6 can be used with this system. In the circuit illustrated in Fig. 8, which is that of a Colonial auto-radio receiver (*Firestone* S7407-5), an untuned transformer T couples the r.f. stage to the converter tube input so that only two variable tuning elements are required even though the r.f. amplifier tube is used. The antenna circuit is tuned by the set of rotary-switch selected mica trimmer capacitors C_p shown at the lower left, while the oscillator is tuned by the set of rotary-switch selected iron-core inductors L_o shown at the lower right—both of these rotary switches S_1 and S_2 (and the third one S_3 which operates the station indicator lights) being oper-

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	10Y	7.5	1.25	Thor.	450	65	15
	HY24	2	0.13	Oxide	180	20	2
	HY40	7.5	2.25	Thor.	1000	125	40
	HY51A	7.5	3.55	Thor.	1000	175	65
	HY51B	10	2.25	Thor.	1000	175	65
	801A/801	7.5	1.25	Thor.	600	70	20
	841	7.5	1.25	Thor.	450	60	15
	864	1.1	0.25	Oxide	135	5	—
	1626	12.6	0.25	Cath.	250	25	5
HIGH-MU TRIODES	HY30Z	6.3	2.25	Thor.	850	90	30
	HY31Z	6	2.55	Thor.	500	150*	30*
	HY40Z	7.5	2.6	Thor.	1000	125	40
	HY51Z	7.5	3.55	Thor.	1000	175	65
	HY1231Z	6 12	3.2 1.6	Thor.	500	150*	30*
V-H-F TRIODES	2C26A	6.3	1.15	Cath.	3500	NOTE	10
	HY75	6.3	2.6	Thor.	450	80	15
	HY1148	1.4	0.155	Oxide	180	12	1.8
	HY615	6.3	0.175	Cath.	300	20	3.5
	955	6.3	0.15	Cath.	200	8	1.8
	E1148	6.3	0.175	Cath.	300	20	3.5
	9002	6.3	0.15	Cath.	200	8	1.8
BEAM TETRODES AND PENTODES	2E25	6	0.8	Thor.	450	75	15
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	6L6GX	6.3	0.9	Cath.	500	115	21
	6V6GTX	6.3	0.45	Cath.	350	60	13
	HY60	6.3	0.5	Cath.	425	60	15
	HY61/807	6.3	0.9	Cath.	600	120	25
	HY65‡	6	0.8	Thor.	450	75	15
	HY67	6 12	4.5 2.25	Thor.	1250	175	65
	HY69	6	1.6	Thor.	600	100	30
	HY1269	6 12	3.2 1.6	Thor.	750	120	30
	1625	12.6	0.45	Cath.	600	120	25
	837	12.6	0.7	Cath.	500	80	12
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	9001	6.3	0.15	Cath.	Sharp cut-off pentode		

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	866A/866	2.5	5.0	Mer.	1000	500	10000
	1616	2.5	5.0	Vac.	800	260	6000
	6AL5	6.3	0.3	Vac.	60	20	460

	Type No.	Average Operating Voltage	Operating Ma. Min.	Operating Ma. Max.	Av. Volts Reg.	Min. Starting Voltage
GASEOUS VOLTAGE REGULATORS	OA2	150	5	30	2	185
	OB2	108	5	30	1	133
	OC3/VR105	108	5	40	2	133
	OD3/VR150	150	5	40	3.5	185

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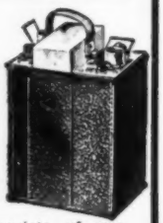

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City ..... State .....

ated by the solenoid which is controlled by the single tuning push-button.

This ratchet-switch system (or minor modifications of it) has been used in a number of auto-radio receivers since it makes possible remote-control with simple wiring between the station selector push-button and the receiver. The single push-button may have to be pressed several times in order to tune to a desired station. The stations on the intervening frequencies will be heard, one at a time, before reaching it. In order to tell which station is being received, separate dial lights (shown at the upper right) for each station may be arranged to light up behind a translucent station-name index, or a rotary dial with the stations marked on it may be arranged to be operated either by the dial mechanism or by a separate solenoid mechanism.

Advantages of System Employing Pre-Set Trimmers or Tuned Circuits

One advantage of push-button tuned receivers employing pre-set trimmers or tuned circuits is that the station selection action is instantaneous. With the exception of those receivers in which rotary selector switches are used, response to the desired station occurs immediately upon pressing the button, as opposed to the somewhat slower action of motor tuning. Also, the over-all equipment setup is mechanically simpler and cheaper than that employing motor tuning. However, with the exception of the solenoid-ratchet-operated arrangement, this does not lend itself to simple "remote" control as required in auto-radio receivers, etc. Also, because the maximum number of tuning positions possible is limited by the stray push-button contact and circuit wiring capacitances and also the minimum-capacitance requirements for tuning to the high-frequency end of the broadcast-band, and since one capacitor (or inductor) per station has to be provided and pre-set for every tuned pre-selector and oscillator circuit in the receiver, these substitution systems are rarely used where automatic tuning to more than six or eight stations is to be provided. A 6-station push-button setup would necessitate the pre-setting adjustment of 12 or 18 capacitors (or inductors) according to whether one or two preselector tuned circuits are used in the receiver. Capacitance-substitution arrangements (Fig. 2) are used chiefly on the cheaper receivers, since they are less expensive than the inductor-substitution types. Their main drawback lies in the fact that, in general, the frequency stability (with temperature variation) of the tuned circuits employing them is not as good as that of tuned circuits in which iron-core inductors are employed instead—unless the more expensive ceramic-dielectric capacitors

(*Continued on page* 128)

They'll Have Everything...

The best of all that's new in radio

Delco home radios will be in production soon . . . table models, consoles *and portables* . . . in FM and AM combinations and with standard broadcast bands. They'll provide the best of all that's new in radio . . . sets that set the pace in styling and performance . . . a line that covers the entire range of customer demand. For *engineering vision* and *manufacturing precision* . . . backed by long experience in producing Delco auto radios and Delco home radios . . . intensified by wartime accomplishments in building military radios and electronic equipment . . . *look to Delco Radio!*

ENGINEERING VISION—MANUFACTURING PRECISION

They Finished Their Job—Let's Finish Ours
BUY VICTORY BONDS

Delco Radio
DIVISION OF
GENERAL MOTORS

DELCO RADIO UNITED SERVICE MOTORS **A UNITED MOTORS LINE**

Within the INDUSTRY

LOUIS J. CHATTEN, formerly director of the Radio and Radar Division of the War Production Board in Washington, has been appointed vice-president and general commercial manager of *North American Philips Company, Inc.,* of New York.

Prior to Pearl Harbor, Mr. Chatten had been sales manager of the *Dictograph Corporation,* vice-president and general manager for *Fada Radio and Electric Corp.,* and Eastern regional manager for *Bendix Home Appliances.* Later he became chief engineer for the *Motor Parts Company* of Philadelphia.

Mr. Chatten had been a member of the War Production Board since July 1943, and became the director of the Radio and Radar Division in August 1944. In this post he had supervisory charge of the wartime output of the entire radio and electronics industry in this country.

* * *

ELECTRONIC LABORATORIES has inaugurated a new division to manufacture toys operated by electronic devices.

The name of the new division is *Elec-Toy,* which expects to be in production of some items for the Chrismas market.

* * *

E. P. TOAL has been named sales manager of standard radio receivers in the Receiver Division of *General Electric Company's* Electronics Department.

Mr. Toal was first employed by the *G. E. Contracts Corporation* at Louisville, Ky., in 1937, as a local auditor. Later he was named district representative for the *Contracts Corporation,* and in January of the following year, was promoted to district radio representative for *General Electric* with headquarters at Minneapolis.

During the past few years, Mr. Toal has been engaged in coordinating the manufacture of electronic tubes for the Navy and Signal Corps and has been responsible for contacts with special accounts of the Receiver Division of the Electronics Department. He will assume his new duties at the Bridgeport, Conn., plant.

* * *

LYMAN ELECTRONIC CORPORATION is the new name for the manufacturing division of the *Springfield Sound Company, Electronics Division,* located at 12 Cass Street, Springfield, Massachusetts. The *Springfield Sound Company Radio Branch,* which is located at 105 Dwight Street, is now under separate management and engaged in the wholesale distribution of electronics supplies. This change became effective October 1.

* * *

BROWNING LABORATORIES, INC., of Winchester, Mass., has announced the appointment of Freeman A. Spindell as chief engineer.

Mr. Spindell spent three years as an instructor of electronics and became associated with *Browning Laboratories* in 1941, where he devoted his time to the designing of radar and radar test equipment.

* * *

F. C. McMULLEN has been appointed chairman of the Aviation Section of the Radio Manufacturers Association's Transmitter Division. Mr. McMullen, who is in charge of aviation radio sales for *Western Electric Company,* succeeds J. W. Hammond of *Bendix Radio,* Baltimore, Maryland. Section membership meetings will be held quarterly, or oftener, and several new section projects are now under active consideration.

* * *

TAYLOR TUBES, INC., of Chicago, together with nine other radio-component manufacturers, has announced the 1st Annual All Amateur Transmitter Contest. Two prizes will be awarded, one in final power input classification up to 250 watts, and the other in power input classification of from 251 watts to 1000 watts. The prizes consist of two transmitters, designed by the contestants, plus $1125 in Victory Bonds furnished by the participating manufacturers.

The participating radio-component manufacturers who are donating the $2250 in Victory Bonds are: *Aerovox Corporation, American Phenolic Corporation, Barker & Williamson, Bliley Electric Company, Gothard Manufacting Company, International Resistance Company, E. F. Johnson Company, Solar Manufacturing Company,* and *United Transformer Corporation.*

Judges of the contest include Fred Schnell, W9UZ, former communications manager of ARRL and now chief of Radio Department, Chicago Police; Oliver Read, W9ETI, editor, RADIO NEWS; Cyrus T. Reed W9AA, former asst. secretary, ARRL; John Potts, editor, CQ and RADIO; Lewis Winner, editor, COMMUNICATIONS; Frank J. Hajek, W9ECA, president, *Taylor Tubes, Inc.;* Rex Munger, W9LIP, sales manager, *Taylor Tubes, Inc.;* and Karl A. Kopetzky, W9QEA, former managing editor, RADIO NEWS.

Official entry blanks, which must accompany every entry, are available from any radio parts jobber or distributor. The contest, which is being managed by *Magazines, Incorporated,* of Chicago, opened November 1 and will close February 15, 1946.

* * *

HAROLD H. LLOYD has been appointed assistant director of the Special Division of the *Emerson Radio and Phonograph Corporation.*

Mr. Lloyd, recently reverted to inactive status, served in the rank of Lieutenant Colonel as Executive Officer in Materiel and Services, in charge of Electronic Training Equipment and Technical Schools. He has been associated with the radio industry for the past twenty-five years and, prior to entering the Army, served as president of the *Engineering Sales Company.*

Mr. Lloyd is assisting in the preparation of plans for marketing of the company's new hearing aid and will also assist in the development of plans for other special products, including commercial television sets, mobile telephone systems, and electronic equipment.

* * *

HERB BECKER has been named manufacturer's representative for California and Arizona by *Bliley Electric Company* of Erie, Pa.

Mr. Becker is located in his new headquarters at 1406 South Grand Avenue, Los Angeles 15, California.

* * *

EARLE D. STREHLOW has been elected vice-president of *Precision Equipment Company,* Chicago, according to an announcement by Walter A. Heiby, president.

Mr. Strehlow, who during recent years has held executive posts at *United Wallpaper Company* and at *Pepsodent Company,* will assume full responsibility for *Precision Equipment Company's* sales and purchasing policies. Among his assignments will be the building of an Industrial Service department to maintain a continually improving source of industrial supply.

* * *

THE AVIATION CORPORATION, New York, has named R. C. Cosgrove vice president in charge of sales.

Mr. Cosgrove, in addition to his new duties, will continue as vice president and general manager of the manufacturing division of the *Crosley Corpora-*

Want a share of Leadership?

Carry RC
Preferred Ty
The Tubes w
Best Known

Now RCA Offers
a Complete Line
of Dry Batteries, Too

In Metal, Miniature, or Gl
THE FOUNTAINHEAD OF MODERN
TUBE DEVELOPMENT IS RCA

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"The RCA Victor Show,"
Sundays, 4:30 P. M.,
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RCA

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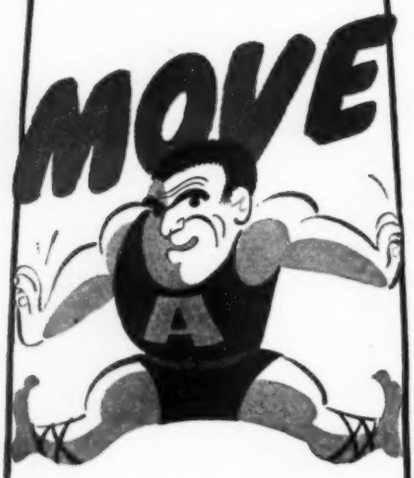
RADIO CORPORATION OF AMERICA
TUBE DIVISION • HARRISON, N. J.
LEADS THE WAY . . *In Radio . . Television . . Tubes . Phonographs . . Records . . Electronics*

Buy Victory Bonds and Keep Them

MAKE IT MOVE with ALLIANCE



Thousands of Alliance "Even-Speed" phonomotors are now leaving the high speed production lines of Alliance every day.

We've done our best, during the war years, to keep all of our customers supplied despite the limited quantities military production permitted us to make. But *now* we're reconverting, stepping up production and quality beyond any previous peak . . . to give you the best, most dependable motor we've ever made!

So plan *now* to drive your turntables, recorders and combination record changers with Alliance Phonomotors!

WHEN YOU DESIGN—KEEP alliance IN MIND

ALLIANCE MANUFACTURING CO.
ALLIANCE, OHIO

tion, which was recently purchased by the *Aviation Corporation*. Mr. Cosgrove is president of the RMA and is also president of the *Crosley Distributing Corporation*.

* * *

GENERAL ELECTRIC COMPANY has completed plans for its new $10,000,000 electronics headquarters plant to be situated on 155 acres of ground outside of Syracuse, N.Y. The new plant will be known officially as *General Electric's* "Electronics Fark" and will be laid out and landscaped like a college campus.

Buildings to be constructed include reception, administration, laboratory, transmitter, receiver, specialty, restaurant, service, boiler house, and a substation. Plans include every modern facility for safe and efficient manufacturing operations, well-lighted, air-conditioned factory buildings and offices, surrounded by a park-like atmosphere and conveniently reached by modern highways leading to and from the plant.

* * *

HERBERT G. ARCADIUS has been appointed district manager of radio phonograph sales, *Meissner Manufacturing Division, Maguire Industries, Inc.* Mr. Arcadius will operate from the Chicago sales headquarters of the *Meissner Division* and will cover the Middle Western area in behalf of their radio phonograph.

For the past twelve years, Mr. Arcadius has been associated with *Lyon & Healy*, Chicago, and prior to that time, was for nine years manager of the radio and radio phonograph department for *Bissell-Weisert Company*, also of Chicago.

* * *

FARNSWORTH TELEVISION & RADIO CORPORATION has purchased the Lucretia Street plant of the *Hosdreg Company, Inc.*, at Huntington, Indiana, to supplement the company's manufacturing and engineering facilities.

Plans for a new building project at Fort Wayne involving an addition to the company's administration and engineering building have also been announced. The manufacturing facilities at Fort Wayne will be utilized for the production of radio and television transmitters, communication and other special apparatus.

* * *

STROMBERG-CARLSON COMPANY of Rochester, N. Y., has started construction of a new $300,000 building alongside its main plant. The new building will have a capacity of 60,000 square feet and will be used for the manufacture of chassis for radio and television sets.

* * *

SENTINEL RADIO CORPORATION has started construction on its new plant occupying a 9-acre tract in western Evanston. The new plant will be housed in a single modern building of 125,000 square feet of floor space. In line with *Sentinel's* production expansion plans, E. Alschuler, president, has announced an extension of national advertising. Supplementing its schedule of black-and-white insertions in farm publications and trade papers, *Sentinel* has launched a campaign of full-color advertisements in several of the leading national publications.

* * *

LAURENCE A. KING, new president and general manager of *The Rola Company, Inc.*, Cleveland, has announced the acquisition of all of the capital stock of the firm by *The Muter Company* of Chicago.

The Rola Company, Inc., a division of *The Muter Company*, will continue to manufacture its present line of loud-speakers, which will be augmented to include new developments in the field.

Mr. King, prior to his appointment as president of *Rola*, was associated with *Operadio* and has been active in RMA affairs. Ben A. Engholm, former president and principal owner, will remain as technical consultant.

* * *

ANSLEY RADIO CORPORATION is moving to a newly acquired plant in Trenton, N.J., occupying an entire square block between North Olden, Breunig, and St. Joe Avenues and Meed Street. The structure maintains a private railroad siding and a parking lot.

Moving of the executive offices, show-rooms, and engineering laboratory is expected to be completed by December 1st.

* * *

MARSHALL B. TAFT has been named assistant to Henry F. Dever, president of the *Brown Instrument Company*, Philadelphia industrial division of the *Minneapolis-Honeywell Regulator Company*.

Mr. Taft was for three years administrative assistant to the vice president of the *Aero Division* of the *Honeywell* organization in Chicago.

* * *

UTAH RADIO PRODUCTS COMPANY has become a division of the *International Detrola Corporation* of Detroit. This change became effective Nov. 1.

* * *

SIMPLEX RADIO CORPORATION, a wholly-owned subsidiary of *Philco Corporation*, located in Sandusky, Ohio, has changed its name to *Philco Corporation of Ohio*.

* * *

AIREON MANUFACTURING CORPORATION has announced the election of two vice presidents at a recent meeting of the Board of Directors. R. R. Greenbaum, for the past ten years connected with the automatic music business, will maintain offices in Kansas City, headquarters for *Aireon*, where he will set up its new automatic pho-

(*Continued on page* 143)

He doesn't read the C-D capacitor....

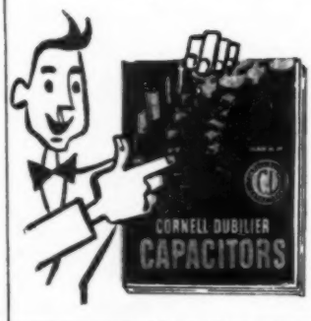
Happy days! There aren't many left like Lucius here who plods along, while the rest of the radio world goes whizzing by. What up-and-coming service man hasn't poked his nose inside our handy, pocket-sized fact-feeder . . . the C-D Capacitor? All the useful news culled from the pages of radio trade papers and digested for you. It keeps you up on cases and is crammed full of helpful hints on every day servicing problems. All this . . . absolutely free!

Let us add your name to our next mailing, and then you'll be on the lookout, yes waylay the postman, for each month's issue. Write to "The Capacitor", Cornell-Dubilier, Electric Corp., South Plainfield, N. J.

HAVE YOU SEEN THESE HELPS?

Trust Cornell-Dubilier to bring you helpful aids and business-boosters for your shop. Here's an eye-catching poster for your window or wall. It tells the customers you're tops in service. It's free; ask your local jobber today.

LOOK AT THIS CATALOG!



Quick, easy condensed reference that gives you the low-down on the most complete line of capacitors in the business. Only one name to remember in capacitors for all your servicing needs: Cornell-Dubilier. Send today for Catalog #195.

"BLUE BEAVERS" ARE TIME-SAVERS!

You really should get acquainted with these special C-D Blue Beavers. They're quick, sure fits for tight spot mounting, and stand up under high temperature and humidity. Two or more can be strapped together to obtain a wide variety of capacity combinations. Ask your jobber!

MICA • DYKANOL PAPER • WET AND DRY ELECTROLYTICS

CORNELL DUBILIER ELECTRIC CORPORATION: JOBBER DIVISION, NEW BEDFORD, MASSACHUSETTS

WHAT'S NEW IN RADIO

CATHODE-RAY TUBE

A double-beam, cathode-ray tube providing two complete "guns" in a single glass envelope, both aimed at or converging on the single screen for simultaneous and superimposed traces, is now available at *Allen B. Du Mont Laboratories, Inc.*

The two independent "guns" of the new *Du Mont* Type 5SP are contained

in a 5 inch envelope. There is complete and independent control of the X, Y, and Z axis functions for each beam. Adequate shielding between "guns" and "plates" minimizes "cross-talk" particularly at high frequencies.

Deflection plate leads are brought out through the glass envelope wall, minimizing shunt-input, deflection-plate capacitance and lead inductance, and also preventing interaction between signals caused by coupling between long leads. Second-anode leads are also brought out through the envelope wall in order to provide better insulation and longer leakage paths.

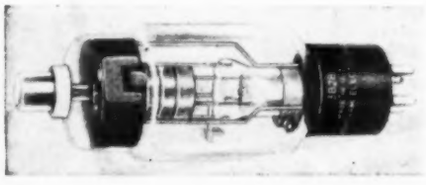
A standard Army-Navy diheptal 12-pin base fits the standard socket. The electrode voltage ratings are similar to those of the Army-Navy preferred Type 5CP1. Contact connectors for electrode leads are supplied with the tube.

Further information on this new double-beam cathode-ray tube is available from *Allen B. Du Mont Laboratories, Inc.*, 2 Main Avenue, Passaic, N. J.

VOLTAGE RECTIFIER

A new Xenon filled high voltage rectifier, incorporating many of the desirable features of both the mercury vapor and high vacuum types is now being offered by *Chatham Electronics* of Newark, New Jersey.

The many features of this new rectifier, made possible by Xenon gas fill and unique construction, include high



peak inverse voltage rating, constant voltage drop, heavy current capacity, and a wide ambient temperature range. The element structure of the tube, which may be operated in any position, is supported by three heavy gauge rods and additionally supported by contact, through shock absorbers, with glass bulb. This tube operates through an ambient temperature range of −75° C. to +90° C.

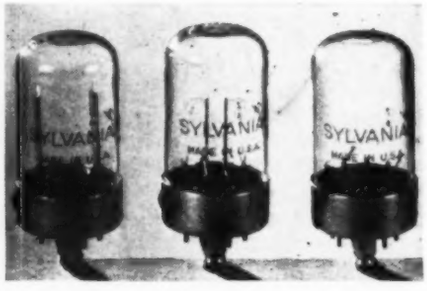
Characteristics of this new rectifier (up to 150 c.p.s.) include filament voltage 2.5 volts a.c., peak inverse voltage 10,000 volts, peak anode current 1 amp. at 10,000 volts and 2 amp. at 6500 volts, average anode current 250 ma. at 10,000 volts and 500 ma. at 6500 volts. Maximum height is 6.38 inches and maximum diameter 2.07 inches.

Characteristics (up to 500 c.p.s.) include peak inverse voltage 6500 volts, peak anode current 2 amps., and average anode current 500 ma.

Details of this new rectifier will be furnished by *Chatham Electronics*, 475 Washington Street, Newark 2, New Jersey.

POWER MEASUREMENT LAMPS

Sylvania Electric Products, Inc., of Emporium, Pa., has announced the development of six types of power measurement lamps for providing a simple,



direct measurement of the power output of electronic and radio communication equipment at frequencies up to 900 mc.

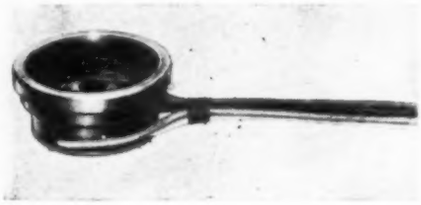
These lamps, built with two identical small filaments and mounted in lock-in type bases, measure power outputs ranging between .05 and 25 watts with accuracies within 5% or less, depending on the type of reading taken. Power output measurements are made by connecting one filament to the high frequency output and the other to an a.c. or d.c. source. Voltage of the second filament is regulated until both filaments are equally bright. Power is determined by meter readings in the a.c. or d.c. circuit with equal power dissipated by the filament in the high frequency circuit.

Useful range may be extended when a dark glass filter is used for visual filament comparison or photo cell measuring equipment is used. Filament characteristics assure constant temperature and color for dissipation of a given amount of d.c. or high-frequency a.c. power.

Ratings, characteristics, and curves of these six types of power measurement lamps may be obtained on request to *Sylvania Electric Products, Inc.*, Emporium, Pa.

TELEVISION CONNECTOR

A new television connector designed to employ a minimum of space behind



the prongs of the tube has been developed by *Alden Products Company.*

In handling electron picture tubes, the tube usually becomes the factor which determines the bulk of the instrument case. This newly designed connector is therefore suitable for application in television sets, oscilloscopes, and similar applications. It has been designed with consideration for the higher voltages, providing longer leakage paths between the contacts protecting the skirt around the prongs of the tube to preclude the possibility of shock.

This new television connector is the product of *Alden Products Company*, 117 North Main Street, Brockton 64, Mass.

FREQUENCY METER

General Radio Company of Cambridge, Massachusetts has announced the development of a new heterodyne frequency meter, battery-operated, for frequency measurements between 10 and 3000 megacycles.

This heterodyne frequency meter, Type 720-A, is compact, self-contained, and mounted in a portable fabric-covered cabinet. The internal oscillator covers a frequency range of 100-200 megacycles and for frequencies below 100 megacycles, harmonics of the unknown frequency are made to produce beats with the internal oscillator. For frequencies above 200 megacycles, harmonics of the internal oscillator produce beats with the unknown frequency.

The internal oscillator uses the newly developed "butterfly circuit" in which capacitance and inductance are varied simultaneously. No sliding

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IF YOU ARE A BUSINESSMAN with a yen to know more about plastics, you'll want your free copy of this illustrated booklet. It tells what plastics will do. It even tells what they won't do. It tells how to go about getting complete data on your project. It goes on to describe production functions from design through the finishing stages—and how to make use of them.

As for the designer, the design engineer and the professional purchaser—men who know plastics from living with 'em—there's something here for you, too. Not technical data on design or materials—which would only get the once-over-lightly treatment in a booklet like this anyway. We mean information on the kind of thinking and equipment offered by a long-established but progressive molder who would like consideration as your source of supply.

The catch? Well, after you've read it, you may want Kurz-Kasch to figure a job for you. Is that bad? We can name plenty of manufacturers who don't think so. Fill in the coupon and attach it to your letterhead. Get a free copy of "A Businessman's Guide to the Molding of Plastics"—and test *your* will power!

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THE STANCOR Catalog provides ready means for you to cash in on the tremendous demand for all sizes and types of transformers, power packs, etc. The radio and electronic markets need them NOW.

There's a pent up demand for STANCOR Uni-Dapt (Universally Adaptable) Transformers—which are now available again. They meet 80% of all radio transformer replacement requirements—being adaptable to varied mounting positions, having heavy insulated leads, electrostatic shielding and special impregnation for long, trouble-free life. Built-in features and refinements—new selling points for you.

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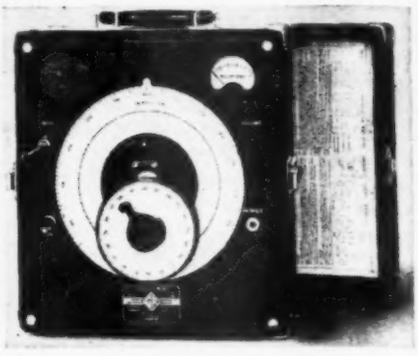
—if you don't have one. Contains wealth of data—charts—tables—innumerable illustrations and pages of useful information on STANCOR Transformers, Power Packs, Reactors, etc., for replacement and general purpose applications—all sizes and types—all top quality.

contacts are used in this circuit and no current is carried by the bearings. The detector is a silicon crystal easily accessible for replacement. A three-



stage audio amplifier is included, having an effective band width of 50 kilocycles. The output of the amplifier operates a panel meter and a built-in loud-speaker, and a jack is provided for head telephones.

The sensitivity of the instrument is high and no direct connection to the source under measurement is required. All tubes and batteries are supplied with the instrument. Dimensions of the unit are 12½x13½x10½ inches, over-all; panel, 10¾x11¾ inches. Net weight is 27¾ pounds with battery.

Additional information on this unit may be obtained from *General Radio Company*, 275 Massachusetts Avenue, Cambridge 39, Mass.

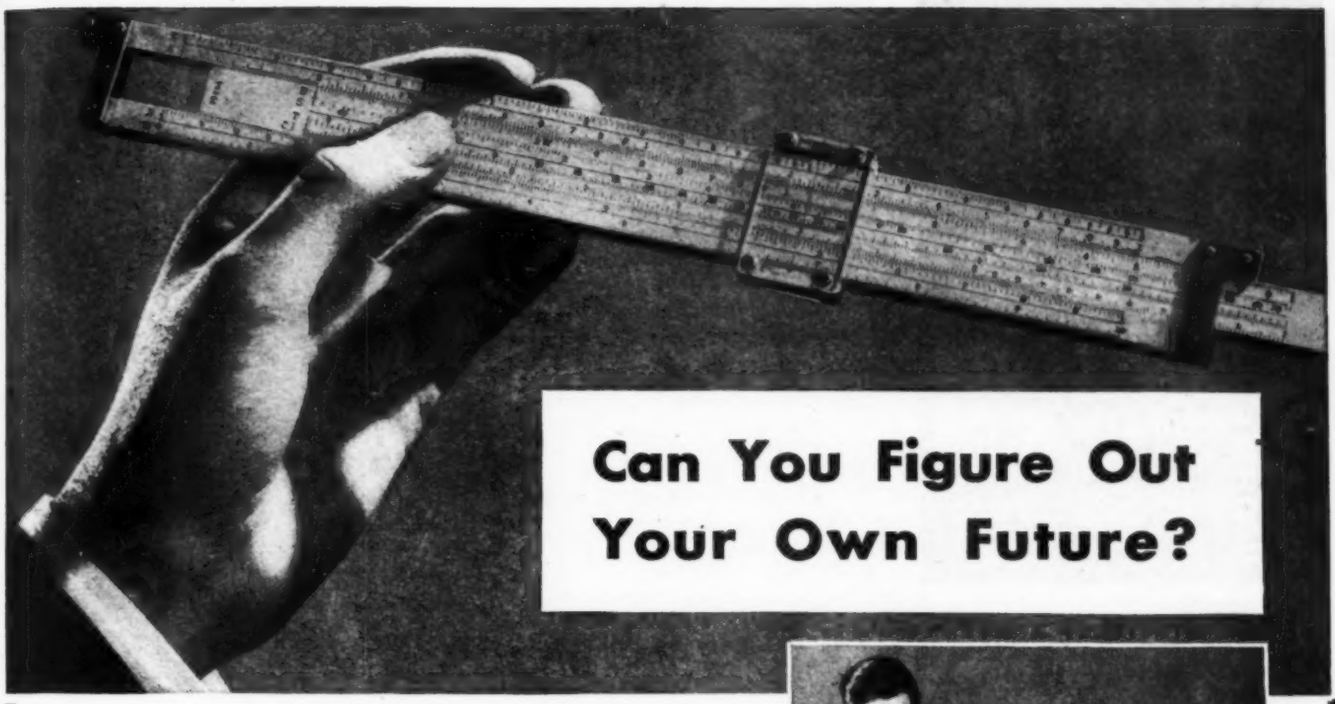
COLORTONE MIKES

A new line of microphones, in color, to supply the growing demand for color harmony in modern living, business, and entertainment is being introduced by *The Turner Company* of Cedar Rapids, Iowa.

These new "Colortone" microphones, in streamlined cases of tough, resilient cellulose acetate, are soon to be released in a choice of richly colored plastic finishes. First colors to be released will include orange, green, yel-

low, and ivory with others to be added, as the variety of color is unlimited with the plastic used. These plastic finishes provide a good insulation against electricity and heat, making the microphones pleasing to handle and safe and comfortable to touch.

The manufacturer has predicted that the appearance and performance of



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"Post-War is NOW!" Prepare now with a planned program of CREI technical training ...get the jump on competition—get that better radio job you want—enjoy security!

Thousands of new men joined the ranks of the radio industry during the war. Now, even more thousands are returning from the armed forces. Competition for the better technical jobs will be keen. Where will you fit into this picture?

If you are wise, you will take action now and *prepare for the good-paying jobs* in radio-electronics. Every man in radio today has the opportunity to see the amazing developments that are taking place, as well as the unlimited opportunities available to men with modern technical training.

It is up to you to decide if you will be a "screwdriver" mechanic or a *real technician* in a *responsible engineering position.*

CREI home study courses are constantly being revised and kept up-to-date with the rapid developments in the industry. What do you know today about U.H.F. circuits, cavity resonators, wave guides, Klystrons, Magnetrons and other tubes? U.H.F. as well as all other basic principles of modern, practical radio-electronics engineering are covered in CREI home study courses.

CREI can help you prepare by providing you with a proved program of home study training that will *increase your technical ability* and equip you to *advance to the better-paying radio jobs* that offer security and opportunity. The facts about CREI and what it can do for you are printed in a 36-page booklet. It is well worth your reading. *Send for it today.*

Servicemen—Discharged Veterans

CREI Residence Training Available Under Provisions of "G.I." Bill

CREI now offers Residence School courses in Radio-Electronics Engineering, Broadcast & Television Engineering and Broadcast & Television Servicing under the Serviceman's Readjustment Act of 1944 ("G.I." Bill.) Classes now in session. Enter at any time. Write for details.

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"Your Opportunity in the New World of Electronics"

TELL US ALL ABOUT YOURSELF, so that we can intelligently plan a course best suited to your needs. If you have had professional or amateur radio experience—let us prove to you that we have something you need to qualify for a better radio job. To help us intelligently answer your inquiry—PLEASE STATE BRIEFLY YOUR BACKGROUND OF EXPERIENCE, EDUCATION AND PRESENT POSITION.

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TEST EQUIPMENT TUBES, PARTS, TOOLS $350 up

Act quickly! Meet the pent up demand for radio service. Turn your special service training into a profitable business of your own. No fuss. No worry. Here's everything you need—$350 up. Details upon request! Write, wire or phone

TRIPLETT
Volt-Ohm-Milliammeter

A. C.-D. C. Volts
0-10-50-250-1000-5000
at 1000 ohms per volt.
D. C. Milliamperes
0-10-100-500
Ohms 0-300-250,000
Case Black molded
3¼"x5⅞"x2⅜".
$16.00 net

Good News! ALL PRIORITIES LIFTED

HALLICRAFTERS SX-28A
$223

SUPER DEFIANT	SX25	$94.50
SKY CHAMPION	S20R	60.00
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ORDERS FILLED AS RECEIVED!!!

MASCO AMPLIFIERS

Complete with tubes.
17 Watt 30.30
25 Watt 42.60
35 Watt 54.60
50 Watt 70.50
17 Watt with Phono-top 42.30
25 Watt with Phono-top 52.20
35 Watt with Record-changer 69.10

PHILCO BEAM OF LIGHT
Selenium Cell only, no holder 1.80

20% deposit required on all C.O.D. orders. 2% transportation allowance on orders of $25.00 or more accompanied by payment in full.

Write for FREE CATALOG

RADIO SUPPLY & ENGINEERING CO., Inc.
129 SELDEN AVE. DETROIT 1, MICH.

these new microphones will influence the planning of sound installations for entertainers, bands, orchestras, television studios, and leisure spots. Manufacturers of home recorders will be able to offer a choice of appropriate colors to match their equipment or blend with home furnishings.

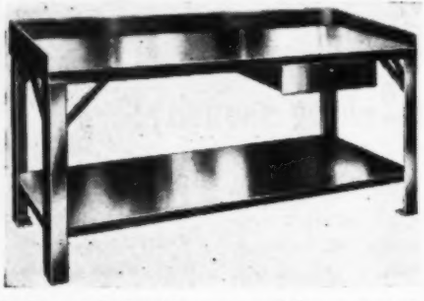
Although primary emphasis has been placed on outward appearance of the new models, materials and techniques discovered during wartime are incorporated into the circuits of both the dynamic and the crystal to improve the standard of microphone performance.

These new microphones, soon to be released, are the product of *The Turner Company*, 955 17th St. N.E., Cedar Rapids, Iowa.

COMBINATION WORK BENCH

Equipto, Division of Aurora Equipment Company has announced the availability, without priority, of its new streamline designed steel work bench.

This new 12-gauge steel work bench may be furnished without back and side railings for use as a packing bench. All four flanges of the bench are formed into a boxed edge for rigidity and a second 12-gauge steel plate may be tack welded onto top for vice reinforcement. According to the manufacturer, this bench is suitable for



both work bench use and for supporting light machine tools and the holes in the four feet permit fastening to floor if desired.

The bench is available in 42 inch and 6 foot lengths, 34 inches high and 28 inches deep. It can be furnished as a plain work bench with 12-gauge steel top and with bottom tray, back and side railings, drawers with padlock attachment, adjustable 3-compartment tray for drawer.

Further details of this work bench may be obtained upon request to *Equipto*, Aurora, Illinois.

WATERPROOF JACK COVER

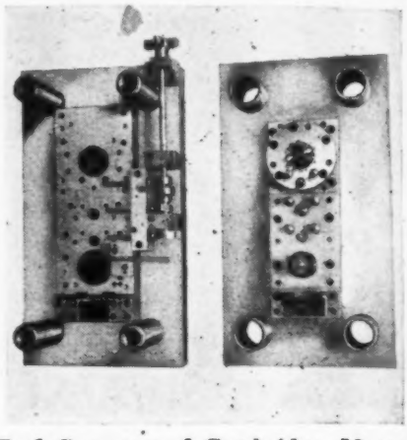
The *Waterproof Electric Company* has announced the release of its waterproof jack cover which completely seals electrical jacks used in radio and electrical equipment. It has been released for general use on government and other high-priority equipment.

When the hinged seal-plug is open, a telephone-type plug may be inserted through the jack cover into the jack in the normal manner. No special holes or tools are required for installation. The seal-plug is available in either red or black and necessary hardware is included.

Further information will be sent on request to *Waterproof Electric Company*, 72 East Verdugo Avenue, Burbank, California.

LAMINATION DIE

A new carbide lamination die used for stamping rotor laminations for small electric motors has been developed by the *New England Carbide*



Tool Company of Cambridge, Massachusetts.

The silicon steel stock is approximately .014" thick and 1⅝" wide. The various steps in the operation consist of punching 9 teeth, 4 pilot holes, a combination shaft and key-seat opening, and cutting off. Solid carbide is used for all the operations, including cutting off, and all pilot pins are made of solid carbide for sustaining accuracy.

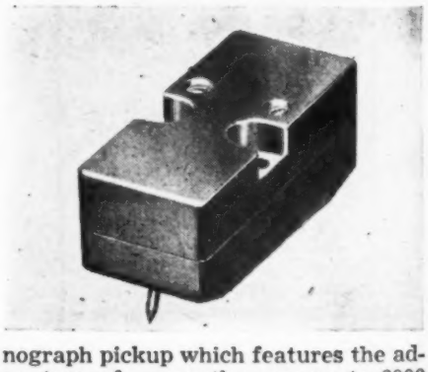
Previous to the manufacture of this die, high-speed steel dies had given production of 35,000 laminations between sharpenings. The carbide die has already produced 500,000 laminations, and has not yet been sharpened.

The manufacturer reports that tests on the motors show that this carbide die produces better laminations which are flat, without burrs, are lower in cost, and the final motor is superior.

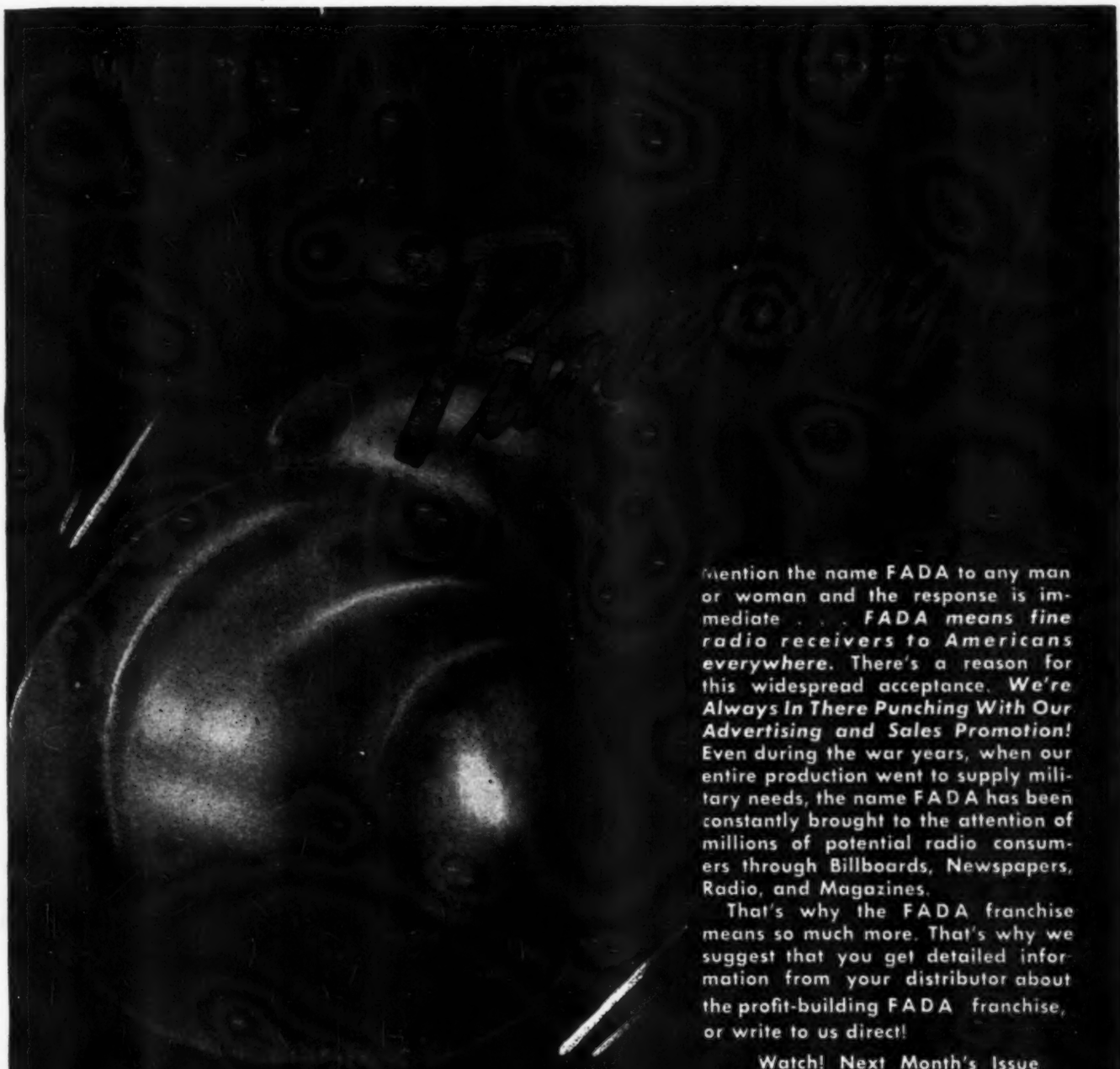
This new carbide lamination die is the product of *New England Carbide Tool Company*, 60 Brookline Street, Cambridge 39, Massachusetts.

MAGNETIC PHONOGRAPH PICKUP

The *Caltron Company* of Los Angeles, California, is now manufacturing a new high fidelity magnetic pho-



nograph pickup which features the advantage of a smooth response to 6000



Mention the name FADA to any man or woman and the response is immediate . . . *FADA means fine radio receivers to Americans everywhere.* There's a reason for this widespread acceptance. *We're Always In There Punching With Our Advertising and Sales Promotion!* Even during the war years, when our entire production went to supply military needs, the name FADA has been constantly brought to the attention of millions of potential radio consumers through Billboards, Newspapers, Radio, and Magazines.

That's why the FADA franchise means so much more. That's why we suggest that you get detailed information from your distributor about the profit-building FADA franchise, or write to us direct!

Watch! Next Month's Issue for Photographs and Descriptions of FADA'S Point-of-Sale Dealer Helps.

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KWIKHEAT SOLDERING IRON

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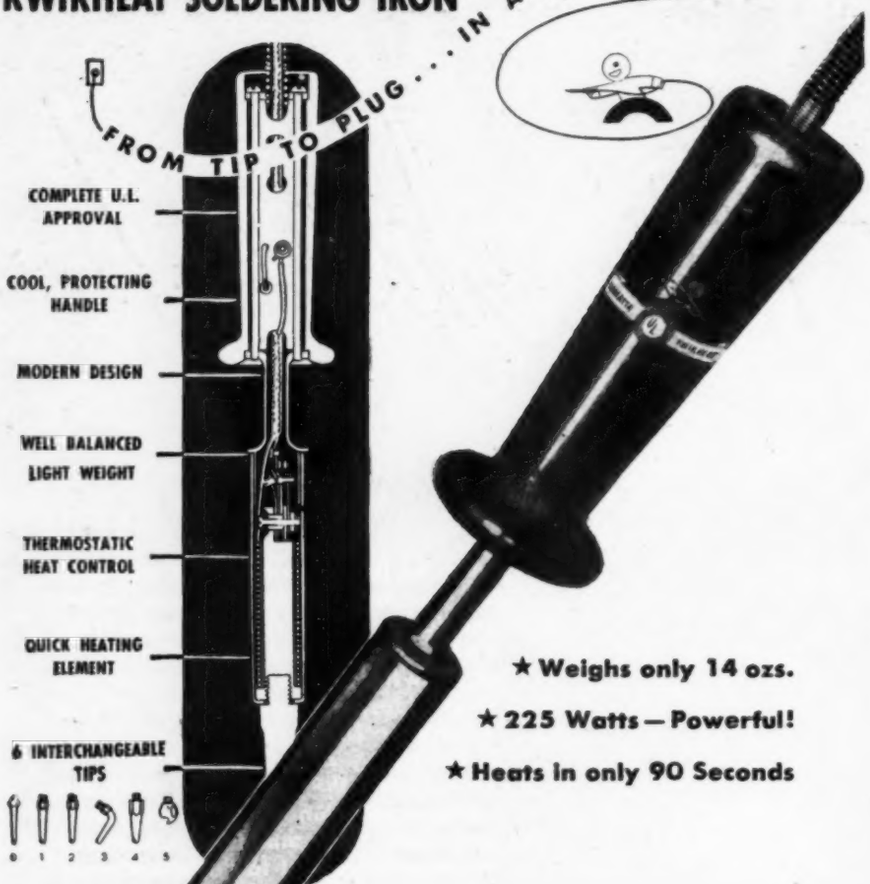
FROM TIP TO PLUG . . .



★ Weighs only 14 ozs.
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★ Heats in only 90 Seconds

Only the Kwikheat has . . .

Built-in Thermostatic Heat Control . . . Check the exclusive advantages that put the Kwikheat Soldering Iron in a class by itself . . . it's *HOT,* ready to use only *90* seconds after plugging in. Saves time. The built-in thermostat keeps the Kwikheat Iron at correct temperature for most efficient work—can't overheat—saves re-tinning time. Powerful, 225 watts, yet it's light (14 oz.)—well-balanced. Cool — safe — protected handle. Six interchangeable tip designs enable one iron to do most jobs. You cannot afford to overlook the Kwikheat Soldering Iron. Write for information—$11 with choice of #0, 1, 2, 3 or 5 tip.

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THERMOSTATIC SOLDERING IRON
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c.p.s. and a sharp cutoff beyond top frequency.

The unit has no bearings, pivots, or needle chuck, and according to the manufacturer, will track fully modulated pressings with 15 grams needle pressure. No scratch filter is required in the amplifier with this new pickup and its low needle talk eliminates problems connected with temperature and humidity.

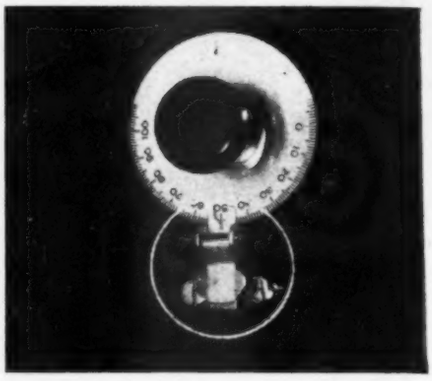
Further details of this magnetic phonograph pickup may be obtained from the *Caltron Company,* 11746 West Pico Boulevard, Los Angeles 34, Calif.

RADIO DIAL LOCK

A new radio dial lock consisting of only two piece parts is now available from *The Radio Craftsmen.*

This new radio dial lock is a specially designed precision piece of equipment that maintains tuning adjustments and assures positive locking action. It has been widely used on the Signal Corps SCR-299 tuning units and is applicable on other radio units requiring an accurate, fast acting dial-lock and tuning indicator.

It is made up of 21 gauge spring brass, nickel plated, and so designed



to permit a wide range of dial thicknesses.

Full details of this equipment may be obtained by writing direct to *The Radio Craftsmen,* 1341-3 South Michigan Avenue, Chicago 5, Ill.

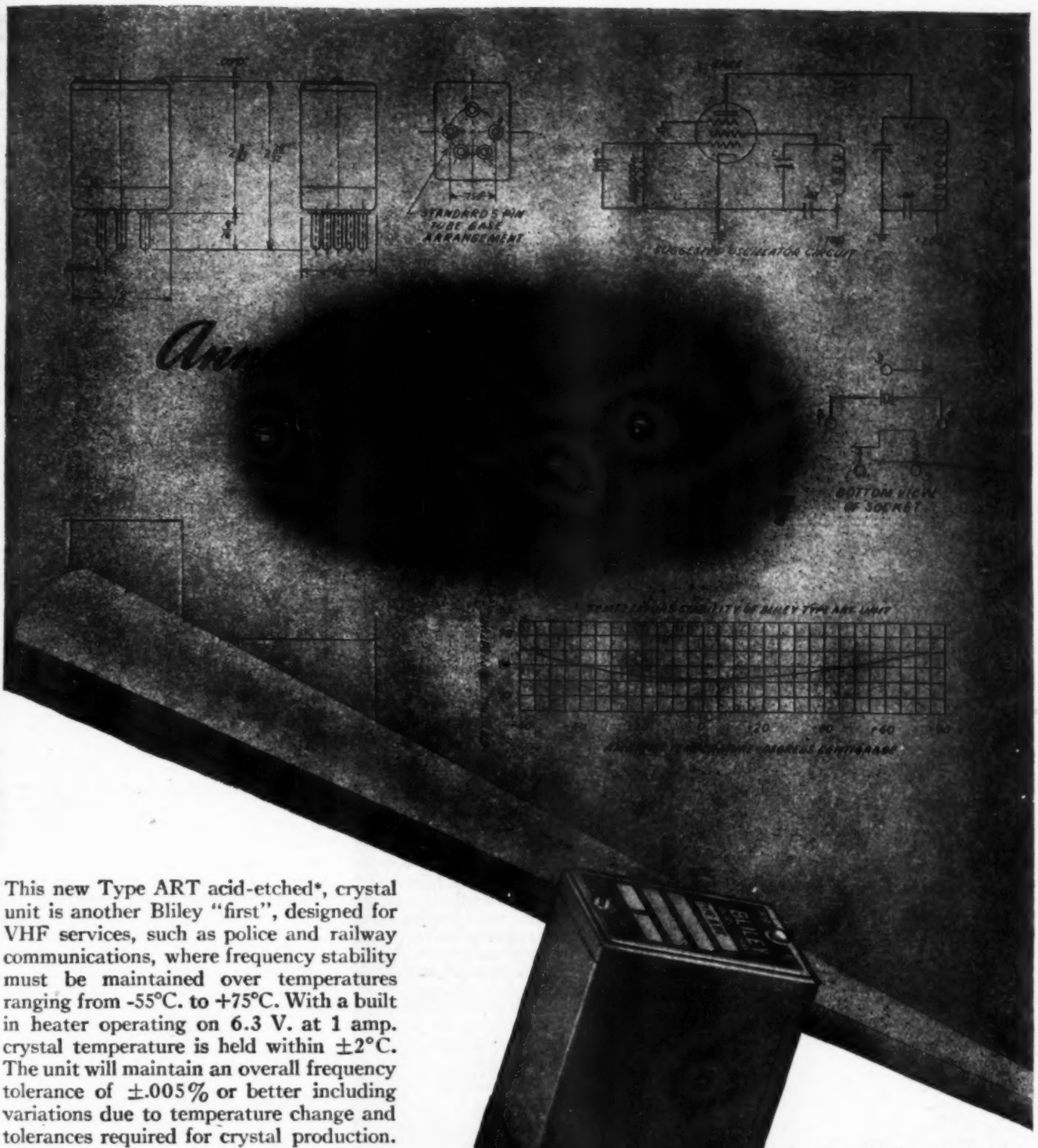
SOLDER GUN

Baker-Phillips Company of Minneapolis, Minn., has announced the development of a new "Flash" solder gun which is said to be faster and save time on close work in cramped or small places.

Many unique features are incorporated in this new model which is equipped for immediate operation from a special 110 volt transformer or from any standard storage battery or from the hot lead on car, truck, or tractor. It is lightweight and "trigger-controlled" for instant heating, hot only when soldering. The new trigger arrangement maintains correct temperature for most efficient work because the operator has full control at all times according to the manufacturer. The natural gun grip is cool, protected, and non-tiring.

The "Flash" solder gun is available in two models, SF100 for fine and gen-

(*Continued on page* 142)



This new Type ART acid-etched*, crystal unit is another Bliley "first", designed for VHF services, such as police and railway communications, where frequency stability must be maintained over temperatures ranging from -55°C. to +75°C. With a built in heater operating on 6.3 V. at 1 amp. crystal temperature is held within ±2°C. The unit will maintain an overall frequency tolerance of ±.005% or better including variations due to temperature change and tolerances required for crystal production. This rugged, compact crystal assembly is available for any frequency between 3500 kc. and 11,000kc.

A schematic diagram of the oscillator circuit and tolerance to be maintained should accompany requests for quotations. See above design for efficient frequency multiplication.

*Acid etching quartz crystals to frequency is a patented Bliley process.

Bliley CRYSTALS

Radio Engineers—
write for temporary
Bulletin RN-26

BLILEY ELECTRIC COMPANY • UNION STATION BUILDING, ERIE, PENNSYLVANIA

Ham Radio
(*Continued from page* 42)

1000 mc. (or 1 kmc.-kilomegacycle).

Insulation Materials.—The problem of corrosive action by free acids on very fine wire, due to the action of air moisture and current, as for instance where tape insulation is employed in high-impedance headphones, small-space a.f. transformers, and the like, has been licked by the use of transparent Lumarith c.a. (cellulose acetate base), which is chemically inert and slow-burning, melting at about 140°F. It is described as a celanese product having high dielectric and tensile strength.

Varnished cambric, or *Empire Cloth* as it is more generally called, finds improvement in a line of acetate tapes. Duplex AA, for example, is a 4-ply tape, only .004" thick, with dielectric strength equivalent to Empire Cloth .007" thick. The thinner acetate tapes contribute to the design of small-space and light-weight transformers of high efficiency.

Glass-base laminated insulation has been considerably improved. Formica FF and MF grades, developed during the war, compare with ceramics in their high-frequency insulation characteristics, yet they machine as do other laminated insulators. They have better insulating qualities than XX or XXX paper-base types; greater strength than linen or canvas base.

Mykroy—here is a plastic insulation so close-grained that a sample rings like glass when bounced on a hard surface. It is produced by the *marriage* of inorganic materials; powdered glass and mica with boric acid, lead oxide and (in slight amount) cryolite. Its characteristics recommend it for u.h.f. and v.h.f. ham work: easily molded or machined to close tolerances; extremely low moisture absorption factor; dielectric constant between 6 and 7; delectric strength over 600 volts per .001" thickness; extremely low power factor. It is said not to carbonize under continuous arcing or flashover. Not strictly a *war baby,* but its use in critical radio application has been greatly widened during the last four years.

At 100 to 300 megacycles, Styraloy 22 exhibits a power factor of only .005. This insulation, developed by Dow, is known as a synthetic elastomer; combined with rubber, it provides flexible, water-resistant insulation. Characteristics—high dielectric strength; low moisture absorption; low power loss; flexible and shock resistance; easily machined or molded.

Inerteen—a new liquid dielectric—is non-inflammable, non-explosive. It makes possible lighter, smaller, and more reliable condensers, of given capacity, for use at d.c. voltages between 400 and 250,000.

Mycalex K is a new sheet and rod insulation having unusual properties. It is available in *pre-determined* dielectric constants between 8 and 15. Low power factor—high dielectric strength. Ideal for use in equipment with variable capacity.

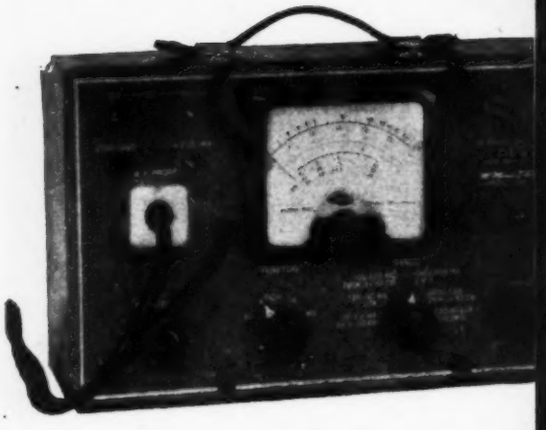
Unusual characteristics also are exhibited in Phenolastic Fiber, a new type of fully-cured, laminated plastic which may be reheated and reformed in shape. This material falls in the thermoplastic group of materials, in contrast with thermosetting materials which set permanently, after application of heat, and which cannot be resoftened upon a second heat application.

Metals.—Hypersil cores in transformers present in solid form, ⅓ greater flux-carrying capacity (together with saving in time ordinarily required for hand stacking) than can be obtained with the tissue-thin laminations previously required in transformers operating at high frequencies.

Iron powders (usually sintered, that is, brought to nearly the melting point) have been improved until today they are primarily useful as electromagnetic material over the entire communication frequency spectrum. Carbonyl SF iron, for instance, is rated as follows: effective permeability at 1 kc., 2.17; relative quality factor (Q) 62 at 10 kc., 71 at 150 kc., 78 at 200 kc., 84 at 1 mc., and 100 at 100 mc.

Alnico-5 magnets will find applications in many amateur radio instru-

SILVER



1. Brand new post-war design . . . positively not a "warmed-over" pre-war model.
2. **More** than an "electronic" voltmeter, **VOMAX is a true vacuum tube voltmeter** in every voltage/resistance/db. function.
3. Complete signal tracing from 20 cycles through over 100 megacycles by withdrawable r.f. diode probe.
4. 3 through 1200 volts d.c. full scale in 6 ranges at 50, and in 6 added ranges to 3000 volts at 125 megohms input resistance.
5. 3 through 1200 volts a.c. full scale in 6 ranges at honest effective circuit loading of 6.6 megohms and 8 mmfd.
6. 0.2 through 2000 megohms in six easily read ranges.
7. −10 through +50 db. (0 db. = 1 mw. in 600 ohms) in 3 ranges.
8. 1.2 ma through 12 amperes full scale in 6 d.c. ranges.
9. **Absolutely stable**—one zero adjustment sets all ranges. No probe shorting to set a meaningless zero which shifts as soon as probes are separated. Grid current errors completely eliminated.
10. Honest, factual accuracy: ±3% on d.c.; ±5% on a.c.; 20∽ through 100 megacycles; ±2% of full scale, ± 1% of indicated resistance value.
11. Only five color-differentiated scales on 4½" D'Arsonval meter for 51 ranges (including d.c. volts polarity reversal) eliminate confusion.
12. Meter 100% protected against overload burnout on volts/ohms/db.
13. Substantial leather carrying handle. Size only 12⅜"x-7⅜"x5⅜".

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The secret of the overwhelming demand for "VOMAX" is just that simple. With it you can measure every voltage in radio receiver design and servicing.

"VOMAX" handles a wide range of d.c. and a.c. voltages at meter resistance so astronomically high that you can measure directly and accurately every such voltage. It goes far beyond conventional volt-ohm-ma-meters. For "VOMAX" will measure every a.f., r.f. and i.f. voltage from 20 cycles right up to beyond 100 megacycles.

This remarkable post-war instrument gives you vitally important visual dynamic signal tracing. Read the briefed specifications at left . . . practically a complete service station by itself . . . see how "VOMAX" makes you the master, no longer the victim, of tough service jobs. Imagine the time you'll save, the increased efficiency, the multiplication of your profits when you put "VOMAX" to work and can at last measure every voltage.

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Born out of the war are many more money-saving new SILVER developments. As an up-to-the-minute amateur you'll want to know all about the new 904 resistance-capacitance bridge . . . new 1.6 thru 30mcs "all-band" 5 to 500 watt transmitting inductors . . . u.h.f. tuners "harnessing" 112 thru 470 mcs. . . . the new SILVER am/fm receiver/kit covering 1.6 thru 150 mcs. . . . new "progressive" 5 to 500 watt xmitter/kit . . . 1.6 thru 500 mcs. absorption frequency meter.

Many headlines like this have raised the question

RADIO RACKETEERS ASSAILED BY COURT

Declaring that radio repairmen were flee
ing customers by charging all the traffic
ing Ma... trate Jam...

Should Radio Service Dealers be Licensed?

RAYTHEON HAS THE ANSWER!

and will announce it shortly . . .

Screaming headlines in the New York Times, the World Telegram, the Herald-Tribune, articles in *The Reader's Digest* — *you* know the unfavorable talk they have helped spread, the hardship they have worked on every *honest* radio service dealer.

DEALER LICENSES DISCUSSED

You are well aware that federal regulation, *dealer-licensing* and even finger printing, are being suggested and discussed by a lot of influential people.

What's the answer? *Raytheon will announce it shortly* for Raytheon has been working for years on a new, foolproof way to protect the public—and to help the *ethical radio service man.* A revolutionary new merchandising plan that will raise the public's opinion of the radio servicing profession and protect the reliable service dealer from outside interests.

GREAT COMPETITIVE ADVANTAGE

You can see the tremendous competitive advantage this Raytheon plan will give every dealer who can qualify! Watch for all the facts on the Raytheon program to protect the public — and help the honest service-dealer!

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RADIO RECEIVING TUBE DIVISION
NEWTON MASSACHUSETTS · LOS ANGELES · NEW YORK
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RADIO Trouble-Shooter's HANDBOOK

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THE BOOK THAT HELPS YOU FIX TWO RADIOS *in the time normally required for one!*

Whether you repair radios for a living—whether you only tinker with them occasionally—or whether you simply want to fix your own radios and phonographs at home, Ghirardi's famous RADIO TROUBLESHOOTER'S HANDBOOK is one big book you can't afford to miss.

You don't have to study it. You simply refer to it when you want to learn how to repair a particular receiver model quickly or when you need specific information, substitution data, etc. on tubes and other components and dozens of other vital subjects. It tells exactly WHAT to do AND HOW. It eliminates the need for using costly test equipment all the time. It helps you repair Radios twice as fast—*and repair them right!*

This big 744-page manual-size book pays for itself in time saved the first time you use it. Now contains 404 pages of receiver Case Histories, giving common Trouble Symptoms, their causes and how to fix them, for over 4000 receiver models. It gives specific data on practically every Radio now in common use.

HOW TO "TEST" A RADIO IN 2 MINUTES!

Simply look up the Trouble Case History data for the set you want to repair. Nine times out of ten, the HANDBOOK will tell you just what is wrong, and EXACTLY how to fix it in a jiffy! No extensive testing! No guesswork! No lost motion! More sets fixed per day!

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This big 744-page book is yours COMPLETE for only $5 ($5.50 foreign)—and it comes to you on a 5-DAY MONEY-BACK GUARANTEE BASIS. You can't lose!

LEARN TO BE A PROFESSIONAL RADIO-ELECTRONIC SERVICE EXPERT

Don't guess! Don't waste time! Know exactly *what* you are doing and *why* you are doing it every step of the way! Ghirardi's MODERN RADIO SERVICING is the only inexpensive one-volume guide that gives you a complete course in professional radio servicing and which includes the essential theory and practice for practically every branch of electronic servicing! You'll be amazed to find how Ghirardi makes even the most "complicated" subjects crystal clear and easy to understand—at home without an instructor. Subjects include thorough explanation of all Test Instruments; how and where and why they are used; Scientific Trouble-shooting Procedure; Circuit Analyses; Test and Repair of Parts; Installations; Adjustments; How to Start a Successful Service Business—*and dozens* more! 706 illustrations; 766 different topics; 720 review questions; 1300 pages! Only $5 ($5.50 foreign). 5-DAY MONEY BACK GUARANTEE!

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Give Ghirardi's Radio-Electronic books to friends this Christmas—*ask friends and relatives to give them to you!* Someone is wondering what on earth you'd like for Christmas. Why not suggest using the attached coupon today. They'll appreciate the hint—and you'll appreciate the books every day of your life!

The books that tell you **WHAT** *to do* **HOW** *to do it*

ments where smaller space, lighter weight and greater magnetic strength and permanence are desirable. In 1940, the best speaker magnets weighed 21 ozs. (for a given use); in 1945, the weight was reduced to 4.64 ozs., other characteristics improving almost proportionately. Incidentally, proper design is very important if maximum flux density is to be realized at the gap. Indiana Steel has perfected mass-production methods for molding alnico, to shape, with tolerances approaching those found in modern plastics.

Powdered metallurgy—this is a new expression with which the advanced radio amateur will need to cope with. In this new process, metal parts may be pressed out of powdered iron, brass, bronze, nickel-cobalt, aluminum and other metals, and subsequently sintered at critical temperatures to attain a solid mass of metal as strong as the same item made from solid metal stock. Pole pieces, armatures, bearings, gears, etc., may be made by this newest technique in American's famed *mass production* methods. Crowley is a pioneer in this business of "making metal parts from powders."

Transformers.—New Amertran-*2-in-1* filament transformers incorporate the tube socket in the transformer body. This eliminates filament wiring and saves material, time and space.

Sola constant-voltage transformers now are capable of maintaining operating voltages constant ± 1% of rated requirements, for line fluctuations as great as 30%.

Some Fedelco-Seal transformers are vacuum-tight, and filled with inert gas.

Audio-frequency transformers and chokes now may be obtained in sizes so small they are claimed by Permoflux to be the *world's smallest.*

Relays.—This component group has been greatly improved both mechanically and electrically. New types are smaller, lighter, and more positive in action. One new relay is a hermetically-sealed unit which met severe Army tests; weighs only 5 ozs. and measures 2" high x 1⅜" dia.

New snap-action relays allow armature to travel some distance in either direction, with gradual current change, before contacts snap into new position. They afford a broad range of use, from vacuum-tube circuits to over-current protection, pulsing circuits, and where close differential or extreme sensitivity of operation is required.

Plug-in relays have been developed by Sigma for ease of servicing.

Time delay as an integral element of the relay design is a feature of the Guardian series 345. On d.c. coils, a time delay of .25-second on release or .06-second on attract may be achieved, through the use of copper slugs which require these time intervals for saturation or de-energizing, depending upon whether they are used on the heel or head of the coil. Adlake plunger-type relays are silent, positive,

chatterless, and quick-acting. Liquid metal mercury and a plunger, the actuating elements, are hermetically sealed into armored glass or metal cylinders.

The thermostatic-metal type of delay relay has been improved by Amperite to provide delays ranging from 1 to 2 minutes. It is hermetically-sealed and compensated for room temperature from −40° to + 110° F., and has contact ratings up to 10 amperes at 115 volts, a.c.

A new Struthers-Dunn keying relay, having the usual multi-pole, double-throw arrangement, also has a high-voltage, high-vacuum switch for handling r.f. currents at high voltage. Incidentally, Heinemann circuit breakers will delay action for up to nearly 10 minutes.

Meters. — These instruments, too, have felt war's *kill or cure* touch. The Marion type HM meter, sealed like a vacuum tube, will meet exceptional needs and at a nominal cost. Its window is double-thickness tempered glass, processed for hermetically solder-sealing the glass to the metal case, after which the instrument is completely dehydrated and filled with dry air at sea-level pressure; the magnetic shielding afforded by the case permits interchangeability on any type of panel without affecting calibration, and silver plating can be added for radio-frequency shielding; kovar glass beads welded to the iron case provide airtight feedthrough connections; a phosphate case finish meets a 200 hour salt-spray test; silver-clad beryllium-copper hair springs reduce zero shift at all temperatures.

Another contribution to meter advancement is the small space construction developed independently by Triplett, DeJur, and General Electric. These meters are 1½" outside diameter; hermetically-sealed.

Still smaller meters, that fit through a 1-inch-diameter hole in the panel, are the minatures made by MB Mfg. Co. They weigh only 1¼ ozs.

Headphones.—For fellows who want their code and phone via the headphone route, there will be lightweight, small space magnetic (moving diaphragm) headphones, such as the Telex Twinset, which hangs under the chin instead of spanning the top of the head, weighs only 1½ ozs., and fits into instead of against one's ear.

Dynamic (moving coil) headphones will also be available, at comparatively low cost, their weight and bulk being offset by such advantages as high fidelity and low impedance. New types are much lighter and smaller than those developed before hostilities.

Batteries—During the war, ways and means were found to bring into the sphere of mass production, certain of the merits of laboratory-type dry-batteries, with their desirable characteristics of continuous high voltage, high relative current output, and long shelf life. Several types of *mercury* cells and batteries incorporating these desirable qualities, have been devel-

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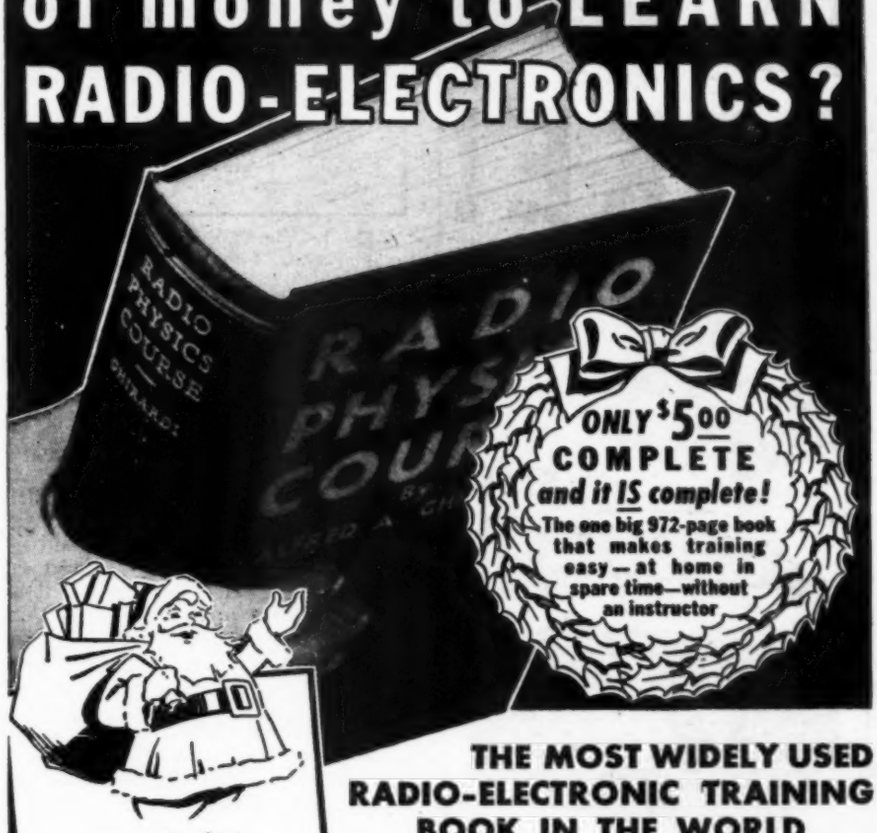
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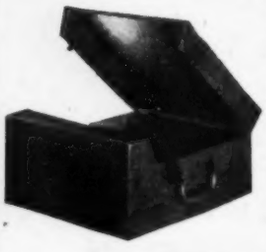
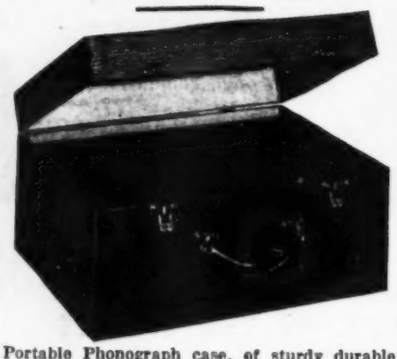


Portable Phonograph case in brown leatherette covering. Inside dimensions 17½" long, 13" wide, 7½" high. Has blank motor board and opening for speaker. As illustrated at left, specially priced at . . . **$7.95**



Portable Phonograph case, of sturdy durable plywood, in handsome brown leatherette finish. Inside dimensions 16½" long, 14" wide, 9½" high. Has blank motor board. As illustrated above, specially priced at **$6.95**

Also blank table cabinets of walnut veneer in the following sizes, with speaker opening on left front side: (*Note: *7 has center speaker grill.)

#1 — 8¼"	L x 5½"	H x 4"	D $1.95
#2 —10¼"	L x 6⅜"	H x 5"	D $2.75
#3 —13½"	L x 7⅝"	H x 6¼"	D $3.25
#7*—10¾"	L x 7"	H x 5½"	D $2.50
#8 —17"	L x 9"	H x 9¾"	D $4.50
#9 —21"	L x 9¼"	H x 10½"	D $5.50

*Speaker Opening in center of front side. Cabinets available in ivory color and Swedish Modern. Write for prices.

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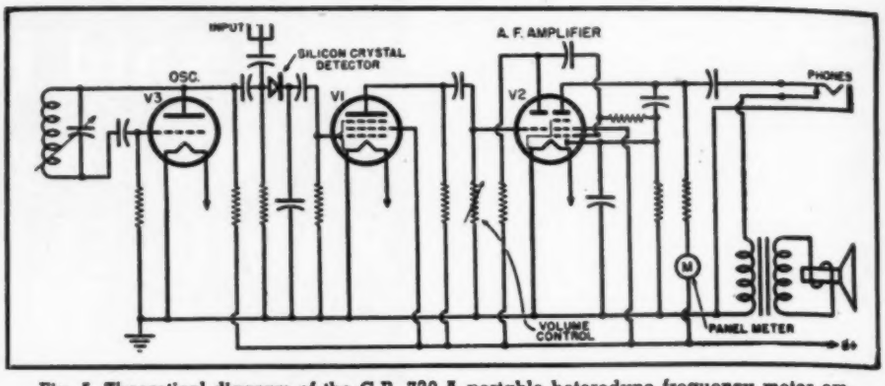


Fig. 5. Theoretical diagram of the G.R. 720-A portable heterodyne frequency meter employing a "butterfly" tuning circuit. Harmonics to the 20th (or 3000 mc.) are usable.

oped by Mallory, Raytheon, Sprague, and Magnavox, following the invention by Samuel Rubin. Although more costly, these *tropical dry batteries* have roughly 5 times the service life of equivalent-size batteries of zinc case (—pole) and carbon rod (+pole) construction; shelf life is in even greater proportion. Comparative curves (for the same current drain, etc.) are shown in Fig. 4. The new cell has a steel case (+pole) and zinc-pellet contact (—pole); zinc foil and impregnated paper, in jellyroll construction and in combination with mercuric oxide, are employed. Being hermetically sealed, they are a solution to the problem of heat and humidity. Other features: substantially constant voltage throughout operating life; same ampere-hour service life, whether drain is intermittent or continuous.

Another battery contribution to portability in ham gear is the Mini-Max 412, a 22½ volt unit weighing only 2½" ozs. Size 2" x 1½" x 23/32" or roughly 30% smaller than the previous type (of equivalent rating).

Equipment

Power Supplies.—Wartime developments in selenium, copper-oxide, and vacuum (tube-type) rectifiers will be reflected in postwar current supply systems. If may be of value to know that selenium types have been made in ratings of 10 microamperes to 10,000 amperes.

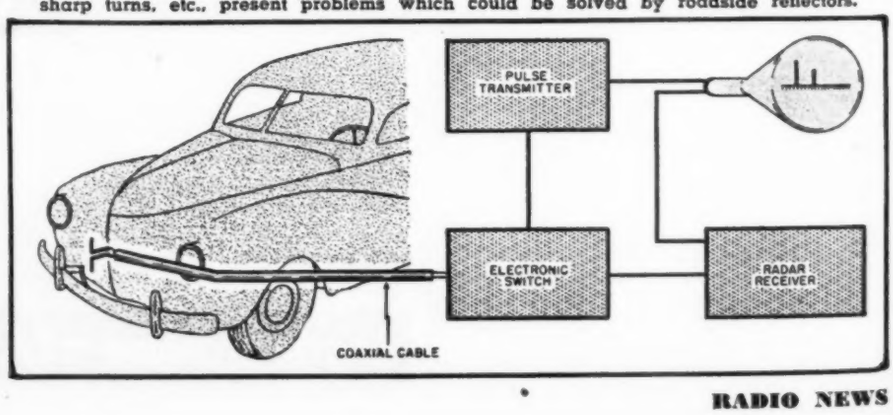
For those amateurs who do not intend to work out their own design of regulated power supply, a number of commercial types are available, to supply low or high d.c. The model 1110 electronically-regulated, 7-tube power supply produced by Communication Measurements is designed for rack-and-panel mounting. It employs a high-gain 2-stage control amplifier. Output: 180 ma. from 300 to 320 v.; total noise is under 5 millivolts. Regulation to less than 1 volt change, no load to full load. Delivers rated output with up to 10% line voltage variation.

A new device for which amateurs may find some use is the Volt-box recently developed by Superior Electric. It affords a current source of 7.5 amperes at 0 to 135 volts, from a 115-volt line. Output is indicated on a meter.

Amateurs in districts *blessed* with a.c. line voltages that swing between wide limits will be interested in the Raytheon voltage stabilizer, capable of holding voltage constant ± ½% within 2 cycles, over an input range of 95 to 130 volts, without any problems of maintenance or adjustment.

More efficient filtering is obtained when the a.c. supply has a sine waveform. This characteristic has been achieved in vibrator-type power supplies devised by Electronic Laboratories. Iron saturation and condenser discharge time-constant are the control factors in this system. The development may solve problems in portable equipment at high frequencies.

Fig. 6. In this representation of an experimental application of radar, a vertical dipole radiates vertically polarized reflective pulses—a sort of radio altimeter working horizontally—for use as a car-radar or safety device in foggy weather. Cliffs, sharp turns, etc., present problems which could be solved by roadside reflectors.



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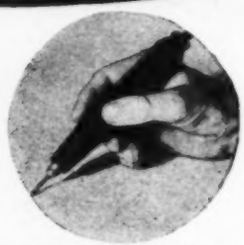

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Negligible frequency error from 50 cycles to 100 megacycles.

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Hash Filter.—Condensers intended for use in hash-eliminating circuits are usually employed in combination—a paper condenser shunted by a mica condenser—to eliminate phase effect. This results in, at best, one anti-resonant frequency. To eliminate this effect—in circuits operating at frequencies up to at least 100 mc.—Sprague has developed the Hypass unit. This is a capacitance/resistance network designed to *settle your hash* problems in all wave receiver circuits, especially those which arise in mobile equipment powered by vibrator-B supplies.

Test Apparatus.—Little improvement has been shown, on the whole, in test equipment relating to ham radio work. There are a few exceptions, of course. Commercial equipment, however, will give us an insight of things to come.

The Ballantine model 300 electronic voltmeter is a test unit for those who want something exceptional for work warranting the expenditure, for an instrument reading from .00002-volt to 10,000 volts, with (approximately) 2% accuracy and with a frequency range of 10 to 150,000 cycles; incidentally, it is useful and usable as a stable amplifier with a gain of 70 db., flat to the top frequency.

Frequency standards will become essential pieces of equipment in amateur radio installations. The Millen #90505 instrument improved type will permit checking frequencies up to 50 mc., against station WWV. A crystal sealed in helium is accurate to 1 cycle/mc./°C., and controls the fundamental frequency of a multivibrator.

Amateur models of pulse (square wave) generators will find their way on the market as soon as hams have done a little work toward adapting wartime pulse transmission to peacetime activities. A commercial unit, in fact, is available. This is the Measurements Corp., model 79B. Characteristics: pulse frequency variable

Table I. The following amateur frequencies have been announced by the FCC. Those below 28 mc. are tentative and subject to ratification by international agreement.

FREQUENCY RANGE (Megacycles)	NUMBER OF CHANNELS (Each 5 kc. wide)
*1.605-1.8	39
3.5 -4.0	100
7.0 -7.3	60
14.0 -14.4	80
21.0 -21.5	100
28.0 -29.7	340
50 -54	800
144 -148	1600
220 -225	1000
420 -450	6000
1145 -1245	20,000
2300 -2450	30,000
5250 -5650	80,000
10,000 -10,500	100,000
21,000 -22,000	200,000

* This range is described in the FCC release as assigned to police, aviation, relay broadcast, special, Alaska, "disaster communication" including amateur disaster networks. It will not be available for general amateur use.

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FOR SALE—R.C.P. #304 tube tester, $12; RCA #104 auditorium speakers, $5 ea.; RCA #60 receiver, $15; RCA #26 portable receiver, $10; several power packs, $5 ea. Majestic speakers, $2 ea. Columbia Kolster 4 tube phono-aplifier, $40. A. Livingston, 12-01 Ellis Ave., Fair Lawn, N. J.

FOR SALE—Triplett multipurpose tester #1501 with directions and test leads, $50. Operates on 117v. a-c; checks tubes, paper and electrolytic condensers; measures d-c milliamperes 0-1-50-250 ma., ohms 0-1000-10M-100M 10 meg., a-c volts 0-10-50-250-500-1000v., d-c volts 0-10-50-250-500-1000v., decibels and impedances 0.-100 Henries. Will sell for cash or trade for good communications receiver. E. S. Coleman, 1001 D.P. & L. Bldg., Dallas 1, Texas.

SELL OR TRADE—Superior #1230 sig. gen. and Cornell-Dubilier condenser bridge type B.N., both A-1 condition. Want Supreme #571 signal generator. Will pay difference. Ralph J. Watkins, 120 Center st., Bangor, Mich.

FOR SALE—Lear Aircraft transmitter modified AMT-1 factory modification 15-watts phone. A-1, complete with Mic. and 500 volt genemotor power supply, $150. Will also sell Triplett #1501 tube tester and V-O-M. Westcott Electric Service, Ontario, Ore.

FOR SALE—1A5GT, 1H5GT, 1N5GT, 12K7GT, 12K8, 12Q7GT, 6A8GT, 25Z5, 25Z6GT, 25L6GT, etc., tubes for sale. Three each to customer. Standard Radio Service, 428 Main st., Hamilton, Ohio.

WANTED—Location in small south or western town for radio shop where there is no other repair shop. Have own tools and equipment. Moderate rent. R. C. Rogers, 1632 Date ave., Alhambra, Calif.

FOR SALE—Complete N.R.I. course in practical radio, servicing and merchandising complete with television servicing and the vacuum tube volt-ohm-meter included in course. W. P. Searcy, Jr., 1916 Fern st., New Orleans 18, La.

WILL TRADE—Riders #6, 8, 9 for volume 2, 12 or 13. O. F. Butts, 117 Second st., Calexico, Calif.

URGENTLY NEEDED—Any make cathode ray oscilloscope. Richard C. Mero, 82C (FCM), Fire Control School, Class 4—46, U.S.N.T.C., San Diego 33, Calif.

FOR SALE — Radio-phono-recorder and public address, dural-speed motor, magnetic cutting head with two mikes, 2 auxiliary speakers. Portable, $225. Modern Method Radio Shop, Box 1006, Glendive, Mont.

WANTED—Signal generator; Riders Manuals and radio tubes. Mac's Radio Service, 712 Romayne ave., Racine, Wisc.

FOR SALE—Audels Radiomans Guide, Vol. 9, and Audels Electrical Library, $5 for both. Daniel Seidler, 4258 S. Maplewood ave., Chicago 32, Ill.

SELL OR TRADE—6V6, 616, 6SJ7, 5 high-power transmitting tubes; 12" speaker with output transformer and 7 technical radio books. Write for list. Want signal generator, tube tester, signal tracer or what have you? Murray J. Pett, 609 E. 170th st., Bronx, New York.

WANTED—Small portable communications receiver with batteries, A-1 condition. Echophone, Hallicrafters, etc., to use in barracks and field. Cpl. F. M. Smith, Jr., 42246878, 13 QM Co., 3BN, 2 Plat., Camp Lee, Va.

FOR SALE—Triplett 1210A tube tester, $15; Model R multitester with instructions, $37.50. Tests ac-dc volts, milliamps, capacity, inductance, reactance and decibels. L. W. Bakewell, 434 W. Locust st., Springfield, Mo.

WANTED—Oscittorcoil broadcast and police #32-1184 for Philco #16 I.F. 460 KC radio. K. V. Woodzelle, 2220 Barclay st., Baltimore 18, Md.

FOR SALE—Philco R-RTL counter tube tester in good condition, has noise test, $15. Larason's Radio Service, Martinsburg, Ohio.

FOR SALE—Sprague 1945 DeLuxe Tel-Omike R/C checker. Only slightly used. K. Champs, Grant Court, Long Branch, N. J.

URGENTLY NEEDED—Parts #3865 and #3864 for Philco #76 radio. C. A. Stinnett, 1721 Elm ave., Lynchburg, Va.

FOR SALE—Two, ea. 32L7/GT and 25L6GT tubes. Also one 35L6/GT tube. P. W. Glaser, Chief Yeoman, U.S.N.R., St. Simons Island, Ga.

WANTED—Used radio technical course texts. Any type of late edition. P.F.C. Jos. Jasewic, Co. A, 33804283, 798 MP., Ft. Harrison, Ind.

FOR SALE—RCP #702 or Supreme #581 sig. gen.; Triplett vibrator check, new; Superior Channel analyzer; multi-meter kit; Riders 1 to 7 and other radio books as well as tubes, resistors and Triplett free point checker. Write for list. Buena Radio Service, Box 23, Buena, Wash.

WILL TRADE—G.H.Q. airplane engine and cash, or cash for a good Hallicrafters SX-25 or S-20. B. Baker, 22 Mechanic street, Hudson Falls, N. Y.

WANTED—Supreme #385 tube tester and analyzer or Supreme #89. John L. Herman, 611 W. Locust st., Bloomington, Ill.

FOR SALE—Weston #669 vacuum tube voltmeter. A-1 working condition with instructions. $28. Val Obal, 4504 S. 41st st., Omaha, Nebr.

WANTED—Two 2,000 KC i-f transformers; .5 MH and .2 MH chokes. V. D. Burgess, 2407 16th st., Lubbock, Texas.

FOR SALE—New tubes: 15—80, 70c ea.; 5—5V4G, $1 ea.; 6—7Y4, $1.30 ea.; 4—6SK7M, $1 ea.; 2—7E6, $1.30 ea.; 3—5Z3G, $1.10 ea.; 6—6V6GT, $1.10 ea.; 4—6S7M, $1.60 ea., and 4—7H7, $1.95 ea. George Howsey, 8120 Third ave., Brooklyn 7, N. Y.

WANTED—Power transformer for use on Sparton #930 receiver, one high voltage, 2 five volt and 1 three volt secondary, center tapped windings. Primary for 100 to 120v., 60 cycles a-c. Wm. Chambers, 825 Angelica st., Rensselaer, Ind.

FOR SALE—Two battery operated signal generators need slight repairs. Want battery-operated signal generator in good shape. G. W. Selby, Columbia, N. C.

WANTED—SX-23 or SX-28A receiver in good condition. Bill L. Godden, 6617 East 9th st., Kansas City 3, Mo.

WANTED—Meissner DeLuxe signal shifter complete with tubes and coils. Henry G. Bergen, Goessel, Kans.

FOR SALE—RCA portable radio 94BP-1, $25, neg. less batteries; also new tubes in original cartons at OPA list. Will trade critical tubes. Goodwin Radio Shop, Rankin, Ill.

WANTED—Complete radio service business or test equipment to run same. State price, etc. Robert E. Cole, Craborchard, West Va.

FOR SALE—New tubes at OPA wholesale ceiling prices. Home Appliance Co., 728 S. Olive st., Los Angeles 14, Calif.

WANTED—For export, large quantities radio tubes and component parts. Also complete sets. Robert L. Shaffert, 501 Fifth ave., New York 17, N. Y.

FOR SALE—National communication receiver #100 XA built-in-crystal-filter and National speaker, $150. Lawrence D. Pritchard, P. O. Box #320, Pittsfield, Mass.

FOR SALE—Speed-O-Meter PB-200 multimeter only used few times, $30 cash. C. E. Brickley, Brickley Electric Service, Farmland, Ind.

WANTED—Specific model car radio for Packard 110, year 1941. Must have trf stage. L. J. Smith, % R. L. Van Ondol, Morrison, Ill.

SELL OR TRADE—Westinghouse electric motor 1/6 h.p. grinding and buffing outfit; heavy-duty Warner brushplater electro-tool set. Want Rider's manuals and test equipment. Lewis Goldstein, 1975 Bathgate ave., Bronx 57, New York, N. Y.

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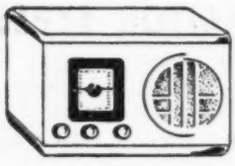

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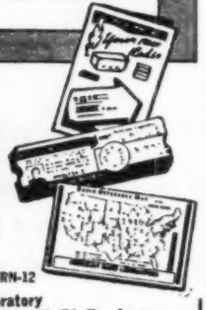

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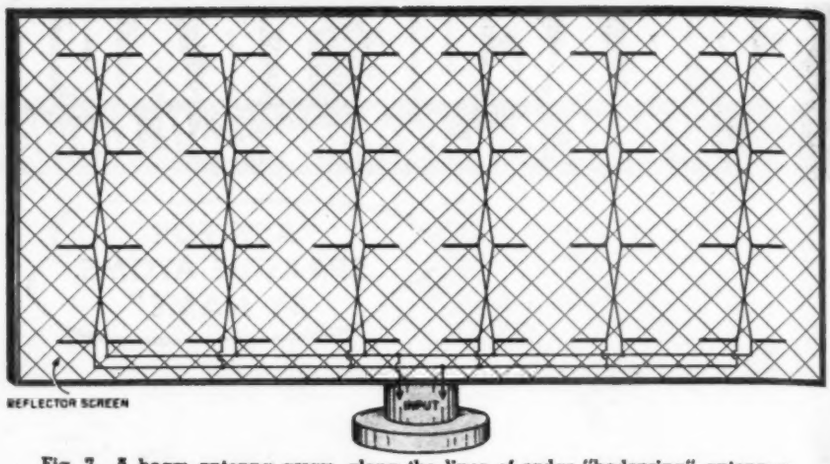

Fig. 7. A beam antenna array, along the lines of radar "bedspring" antennas, may aid hams to increase the range of v.h.f. transmitters and receivers. The type shown here employs 24 half-wave dipoles, horizontally polarized, connected in and out of phase. Wire mesh reflectors extend along rear, ¼ wavelength away; directors and more reflectors will increase the effectiveness of the array.

between 60 and 100,000 cycles; pulse width, 0.15- to 50 microseconds; output, approximately 150 volts, plus. A built-in carrier modulator applies pulse modulation to any r.f. carrier below 100 mc.

Precision frequency calibration up to 2000 megacycles is possible with a Lavoie harmonic frequency generator. Output voltages which are multiples of 10 mc. or 40 mc., with crystal-controlled accuracy, are selected by means of a switch.

For measuring and monitoring amplitude-modulated transmitters, General Radio offers (1) a frequency meter with a range of 0 to 60,000 cycles, ± 2% of full scale, and (2) a frequency monitor for carrier ranges of 1500 kilocycles to 200 megacycles, with ± .003% accuracy. They possess a number of advantages over prewar equipment.

Another G.R. item, of use in ham work, is the 720-A heterodyne frequency meter, range 30 mc. to 3000 mc. The instrument is continuously variable between 100 and 200 mc., fundamental; frequencies above and below are measured by harmonics. A loudspeaker is self-contained; headphones plug in for weak beat notes. A new circuit known as the *butterfly* (Fig. 5) provides high power (without sliding contacts) at ultra-high frequencies.

New Hammarlund tuning devices will employ a technique not previously associated with 600 mc. operation. It permits the construction of conventional resonant circuits.

So much for the few components we have had room to mention, and merely stating the claims made for the respective items. Now let's see where some of them may fit into the ham picture as a whole.

Radar—or "Reflective Pulse Transmission"

Right here we wish to emphasize the fact that radar has made an indelible impression on the *art*. Its ramifications are many, and its effects far-reaching, general opinion at the moment to the contrary notwithstanding.

Radar is a coined word, derived from the phrase which describes its basic function: *radio detection and ranging*. In radio d.f. (direction finding), a directional receiver locates a point source of primary radio signals. In radar, a directional receiver locates a point source of secondary radio signals.

In radar, unlike radio d.f. little control of the (secondary) radiation is possible, and therefore, sources of signal reflection are unwittingly disclosed upon reception of coded impulses.

In radar, as in radio d.f. if the receiving antenna is properly arranged, the source of the signals may be located in azimuth and zenith, and plotted with respect to the points of the compass.

Effective radar performance is based upon these fundamental conditions:

(1) Generation of short pulses, timed or coded, at long intervals;

(2) Radiation of these pulses on a beam in a given direction; and,

(3) Reception of these pulses, as reflected, and electronic analysis of the time-distance relationship of the coded impulses.

From these roots will grow and branch a host of important applications. Meanwhile, hams with a flair for sports soon may take up *radar hunting*, inasmuch as large birds even now may be spotted through fog, etc., at distances up to several miles. Or they may try out on land, radar anti-collision equipment on the ubiquitous *jalopy*, for use in fog as suggested in Fig. 6. On the water, they may use the equipment on motorboats, in the dual role of an anti-collision device and as a direction finder. Radar operation ranges between 100 mc. and several thousand; that is, a few centimeters, depending upon the service required. In some types of service, through the use of an electronic switch or fast-operating relay, the same antenna may be used to transmit and receive, as shown by block diagram, Fig. 6.

True, there's lots of experimenta-

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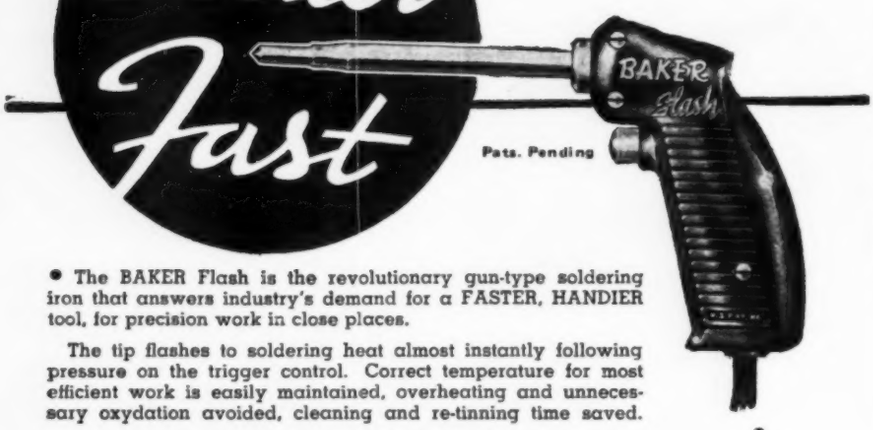

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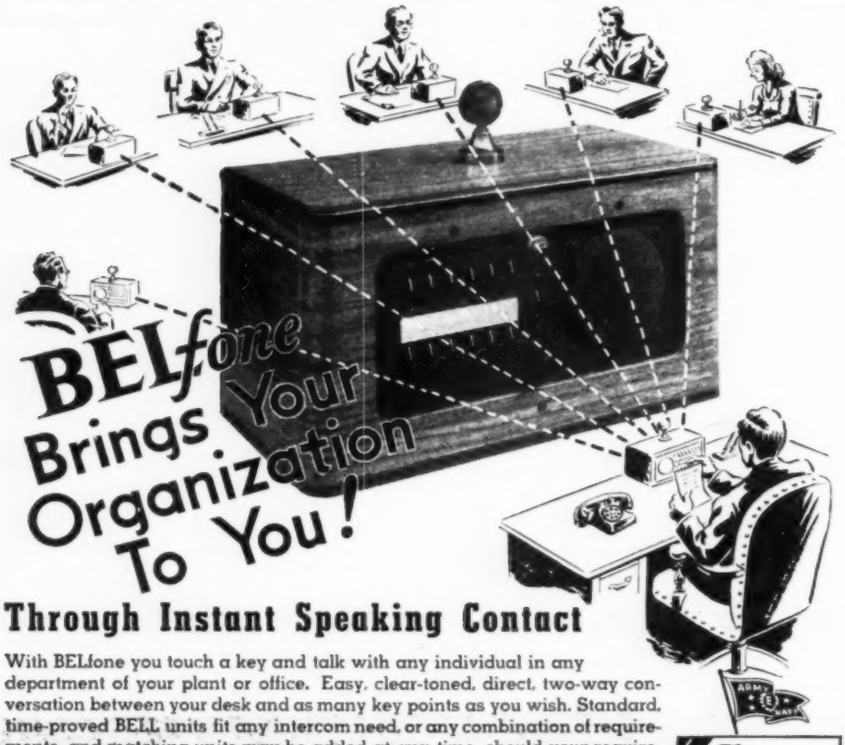

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tion involved in these ideas, but it's *duck soup* for that segment of the ham fraternity which we might dub the *ex-perimental fringe.* Other features of radar, not mentioned here, will be adapted to his needs by the communications amateur.

Miscellaneous Activities

Facsimile—or impulse recording—has shed its cocoon and, through the exigency of World War 2, emerges to spread its gossamer wings. While advanced amateurs may resort to the use of photographic film, for high contrast and detail, the excellent black/white range and considerable definition obtainable through the use of Alfax paper will interest the average radio amateur who wants to experiment with facsy. Alfax is an electro-sensitive paper with controlled moisture which is easily maintained until use by packing in sealed tin cans; and by treating it chemically, after recording, it may be used to obtain blueprints. One so slow—3 sq." per minute—facsy can now deliver a page the size of RADIO NEWS in about a minute.

Impulse recording on photographic paper, film, electrolytic paper, and perhaps in ink, will expand into color work, just as this possible achievement was demonstrated, here and abroad, before the war. It was your senior writer's experience to witness American color-facsy experiments on paper, around 1939, and to see birds of paradise and other examples of gorgeously-colored French recordings on paper and silk, several years earlier.

The development of prewar television was aided and abetted by the work of VK3JU (the late Ross A. Hull), WIAL (James A. Lamb), W2AKF (Philip Rosenblatt), W2KJL (Marshall P. Wilder), W2DKJ (Arthur Lynch), W2GJR (William Still), W2IUP (Howard C. Lawrence), and other licensed hams. We conclude that postwar 2-way television, in black-white, color, and 3 dimension, will interest a still larger number of radio amateurs as soon as tubes and a few basic components become available. (Mr. Kit Manufacturer, are you listening?)

Not every electronic application will spring full-blown into ham radio. Perhaps, in time, the FM *carrier induction* method of communication, employing wayside wires, may help bridge a gap in amateur activities, especially in rural areas. Aireon Mfg. Corp. has taken the lead in its commercial development as a means of relieving traffic congestion on more established methods of communication.

Recording will again interest many hams but, whereas previously only discs were employed, tape and wire will present advantages. Cellophane-tape recorders will climb down from broadcast studio and enter the ham shack. Their use will accelerate experimental work by affording the equivalent of a stand-by station operator for monitoring the results of field tests. Paper-tape recorders and in some cases transmitters have been im-

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Fifteen tubes are employed in the S-36-A including voltage regulator and rectifier. The RF section uses three acorn tubes. The type 956 RF amplifier in conjunction with an intermediate frequency of 5.25 Mc. assures adequate image rejection over the entire range of the receiver. The average over-all sensitivity is better than 5 microvolts and the performance of the S-36-A on the very high frequencies is in every way comparable to that of the best communications receivers on the normal short wave and broadcast bands.

The audio response curve is essentially flat within wide limits and an output of over 3 watts with less than 5% distortion is available. Output terminals for 500 and 5000 ohms and for balanced 600 ohm line are provided.

NOTE: For those requiring higher frequency receivers, Harvey can now supply from stock the Hallicrafters Model S-37, with a frequency range of 130 Mc. to 210 Mc.

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proved by McElroy, Teleplex, and Mecanitron, to name 3 companies. Work by Lear Radio, Utah Radio, and others, in recording on wire for Government agencies will be applied in ingenious ways by amateurs working with field equipment as well as fixed-station setups; there's no reason why proof of reception cannot be made on location, upon wire, and later dubbed to permanent records (tape, disc, or wire). In the latter connection the pocket-size wire recorder recently developed in collaboration with Armour Research Foundation may prove of value; independent work on this type and size of recorder has also been done by Brush Laboratories.

Frequency-selective filters have been greatly improved, so that relays in the output circuit may be operated on closely-adjacent channels. Audio Development discloses that one hermetically-sealed model weighs only 10 ozs., has 25 db. discrimination at ⅓-octave with bandpass ± 1½ db. over ±3% of mid-frequency. A Freed Transformer unit provides 5-channel selection. Such filters may find application in ham relay setups, in which one ham station may *trigger* an unattended relay station, at a remote point, and thereby extend the range of the first station, perhaps even to transcontinental distances.

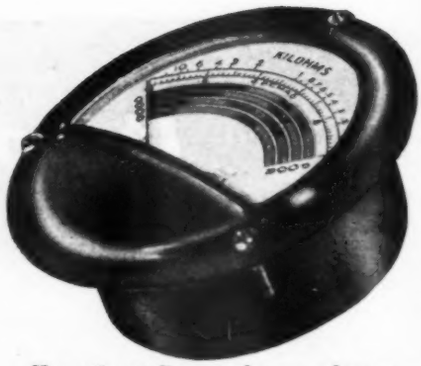
Visual tuning in the manner exemplified in Panoramic receivers will appeal to advanced hams, and will aid greatly in handling heavy traffic by permitting an entire ham band, or several bands, to be continuously monitored while awaiting an opportunity to make contact with one of several busy stations. Perhaps other applications of this type of equipment, in which transmitters are identified as *pips* along a horizontal line on a cathode-ray tube, will be found by amateurs employing manufactured or home-built *band scanners*. One commercial model is the Hallicrafters S-35.

Diversity reception will soon become popular as an effective anti-fading means for handling traffic on several of the ham bands. The market awaits suitable receivers embodying wartime developments. Signal shifters also will regain a place in amateur radio transmitter set-ups.

In order to acquire a better perspective, let us consider a few of the factors involved in ham operation at, let us say, about 2500 megacycles.

For operation at frequencies in this region, many changes in our installations will be noted as antennas, circuits and tubes, all involve specialized techniques.

Elaborate antennas at proper height and location, will aid in compensating for much of the equipment to which we are accustomed, by helping achieve greater distances with less power. Rotating beams with a dozen dipoles, and more, in proper phase relationships, will become common. Remember, at these real high frequencies, you can literally put a dipole and several reflectors in your hat!



Hermetic sealing marks an advance in meter construction, protects movement against atmospheric conditions.

In Fig. 7 a portion of an early-type radar antenna is shown. This general type of *bedspring*, employing a multiple array of dipoles connected in- and out-of-phase, and with reflector system, was utilized in ranging anti-aircraft artillery, and may lend itself to amateur radio experimentation.

Not only must power be radiated, but it must also be transmitted from the generator and in v.h.f. operation this subject is of exceptional importance. To transfer power from oscillator tank to radiator, *well-designed* and *properly terminated* transmission lines must be employed; below 1000 mc., it is probable that coaxial lines will continue to be employed, but at higher frequencies, rectangular wave guides constitute a convenient and much more efficient means of energy transfer.

In 2500 mc. operation, multivibrators will probably operate in conjunction with quartz crystals, as the source of frequency, because of the difficulty of multiplying crystal fundamentals to the required degree. For example, to generate a frequency of 2800 mc., it would be necessary to multiply a 40-mc. crystal frequency 70 times, and the resulting 70th harmonic would be almost imperceptible, unless amplified, due to the low energy available at the fundamental frequency. The multivibrator is rich in harmonics of high power at high frequencies, in contrast with crystals, whose harmonic frequencies are highly attenuated. (The rate of oscillation of a multivibrator, by the way, is controllable from a few millionths of a second to hours).

According to grapevine information from the slipstick boys, even the multivibrator soon may be superseded by dynatron oscillators, employing special dynatron tubes (along the lines of highly efficient types developed by Western Electric), due to the fact that much greater power is obtainable from the latter at v.h.f. *fundamentals*.

It probably will be desirable, if not essential, to deliver virtually pure d.c. to tube plates. This may be accomplished economically by supplying high-frequency currents, up to several thousand cycles, to the plate transformer primary, thus greatly increasing the efficiency of filters. In any event, well-regulated power supplies will be needed.

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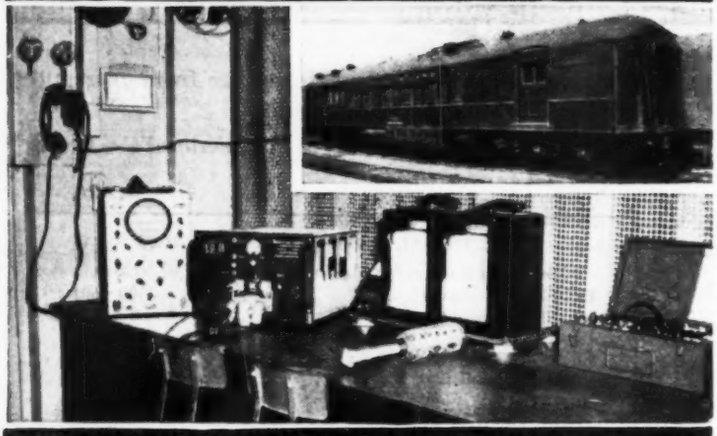

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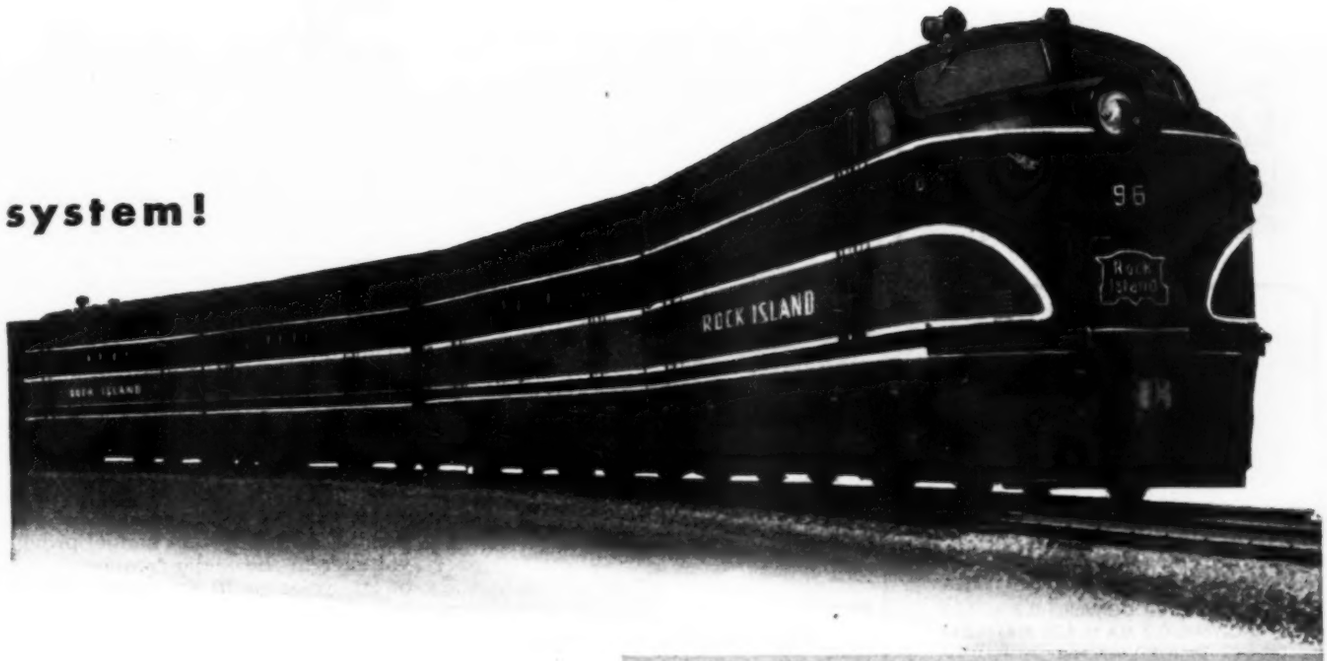

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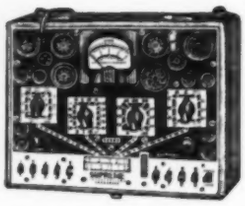

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Although new tube types are available for specialized application at these frequencies, surprising results can be secured with conventional tubes in proper circuit arrangements. For example, if the radar principle of pulse transmission is employed, as it will be, such tube types as a pair of 807s may be used since power may be supplied, at high voltage, only momentarily.

We conclude on an intriguing note: Experiments seem to indicate that perhaps even frequencies formerly considered *line of sight* (without recourse to relay stations—either manual or automatic) may bridge continent and ocean, granting sufficient transmitter power and receiver sensitivity, our previous concept of range having been predicated on the performance of low-efficiency and outmoded prewar equipment.

(The writers wish to extend credit and express appreciation to "Bill" Harrison, W2AVA for cooperation in the preparation of this article).

—30—

The Audio Chanalyst

(*Continued from page* 34)

10-ohm connection, the latter of which is used for direct loudspeaker testing. A built-in 600-ohm load resistor is included for amplifier termination use in silent monitoring practice. The loudspeaker can be switched in and out at will to provide an audible signal; since it is operated at much less than its normal capacity, its loading effect is almost negligible.

The amplifier channel is also designed to be used as a substitution unit for checking the performance of amplification systems or any type of audio amplifier. It can be substituted as a complete unit to check the gain between an input source (such as a microphone), and a loudspeaker, or it can be used sectionally to substitute for any defective stage of an amplifier under test. Provision is made to operate a defective amplifier by substituting a high-gain voltage amplifier section or an intermediate or power amplifier section of the Audio Chanalyst as a temporary replacement unit. A signal applied to an amplifier under test can be routed through a section of the Audio Chanalyst which bridges any possible defect; the same signal can then be returned to the operative part of the amplifier being tested.

Another very useful application of the Audio Chanalyst is found in the silent or audible monitoring of intermittent amplifiers. As mentioned before, the four individual sections of the amplifier can be used independently, thereby playing an important role in checking intermittent operation of any amplifier under test. Three check points can be simultaneously monitored, one by the voltmeter section, another by the indicator eye, and the third by the speaker channel. In this connection the three sections can be applied to give a constant check on a

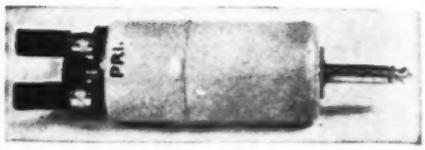
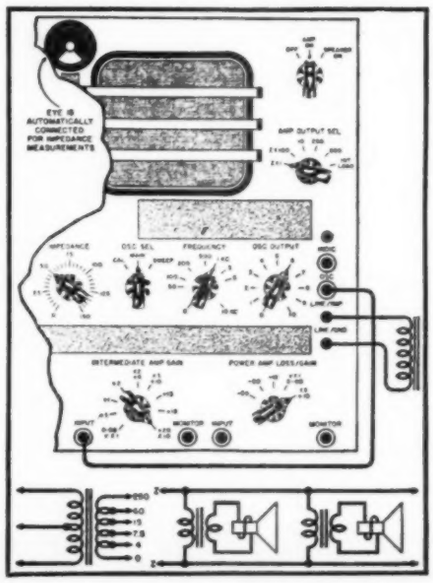


Fig. 9. This matching transformer is not supplied with regular equipment but as an accessory. It has a tapped primary of 250 ohms and a secondary of high impedance for use as an input transformer to the amplifier. It may be used as either a balanced or an unbalanced input for microphones or a line.

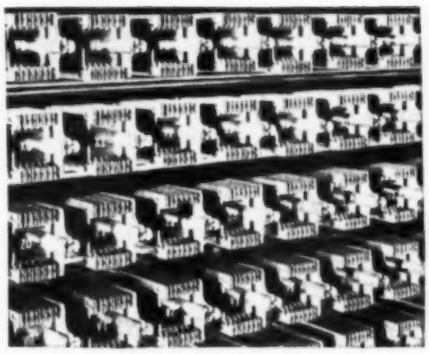
signal such as might originate in the oscillator section to determine when that signal is altered by an electrical defect in an intermittent amplifier undergoing test.

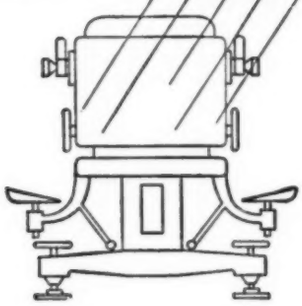
Built into the new Audio Chanalyst is a complete beat-frequency oscillator which serves as a signal source for signal tracing and impedance measurements. The oscillator channel provides voltages in the audio-frequency range of 20 cycles to 10,000 cycles and may be used as a testing device for checking a complete audio system, speakers, and other audio-frequency devices. The output level is variable, with a maximum of about one volt. The output of this oscillator can be introduced directly to an amplifier at low level or, if desired, the oscillator output can be amplified by the last stage, or the last two stages, of the amplifier channel, thus providing a high-level signal for checking power amplifiers. The oscillator frequency can be controlled manually throughout the most commonly used part of the audio spectrum. This makes it possible to test loudspeakers, either with the one-watt output of the Audio Chanalyst or with the sup-

Fig. 10. Impedance checking. Below is shown the control setting for measuring impedance of 50 ohms at 1000 cycles. The impedance of several speakers across a common line can be easily determined by employing the Audio Chanalyst. After this is determined, it is a simple operation to connect these speakers to the proper lug on the output transformer, as depicted by the schematic diagram.



Target practice with Relays and Keys





(Left to right) The operator punches the problem data on tape, which is fed into the computer. The solution emerges in the teletype receiver. Relays which figure out the problem look like your dial telephone system.

In designing the gun-control systems which shot down enemy planes, Army ballistic experts were faced by long hours of mathematical calculations.

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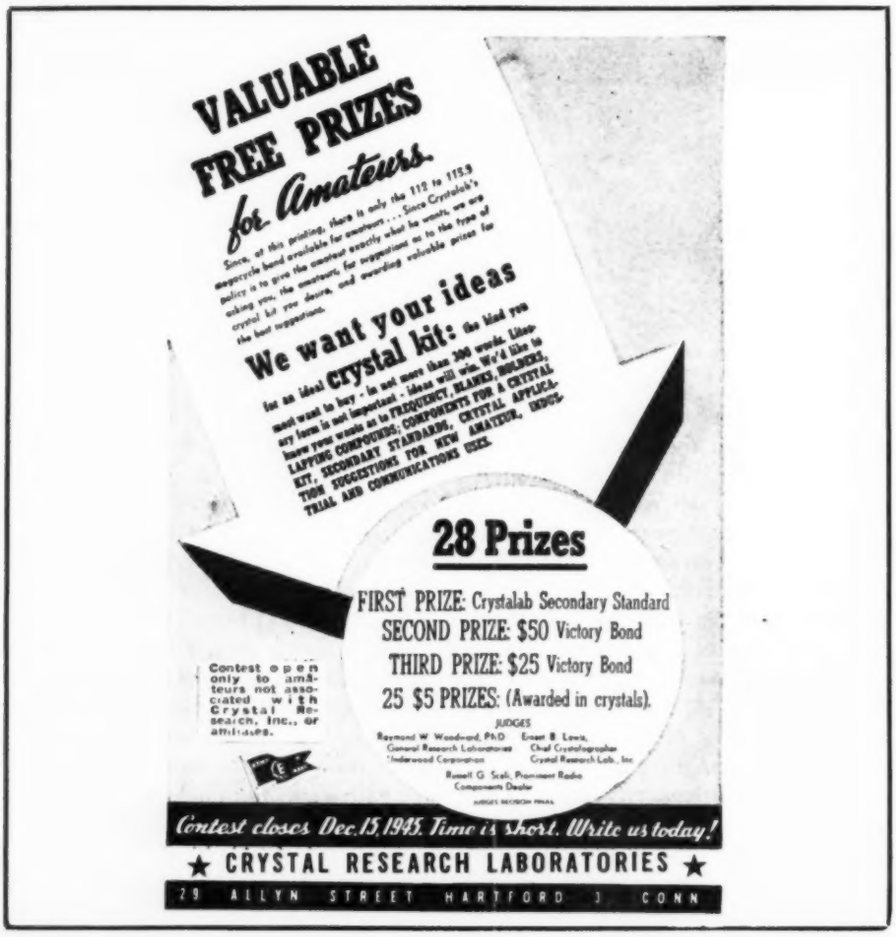
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★ CRYSTAL RESEARCH LABORATORIES ★
29 ALLYN STREET HARTFORD 3 CONN

plementary power of any other amplification system.

If it is desired to match the oscillator output with a low load impedance of any external device, the signal can be taken off at the two binding jacks marked *line*. The signal at this point will have an output suitable to match load impedances of 10 ohms, 250 ohms, or 500 ohms, dependent upon the position of the *amplifier output selector* switch. It is possible also to obtain an attenuated low level output at 500 ohms, when the amplifier output is connected to the internal load. The *line* binding jacks then provide a signal 60 decibels below the level across the internal load resistor, which may be operating at one watt or less.

An innovation in the design of commercial audio testing devices is included in the new Audio Chanalyst, which makes it possible to operate the beat-frequency oscillator channel automatically. A repeating sweep of frequencies between 0 and approximately 3000 cycles is provided for loudspeaker testing; it will be found extremely useful in locating defects in multiple speaker installations. With the sweep on, maintenance engineers can walk from one speaker location to another listening for the characteristic buzz of a defective speaker as all speakers respond to the sweep range.

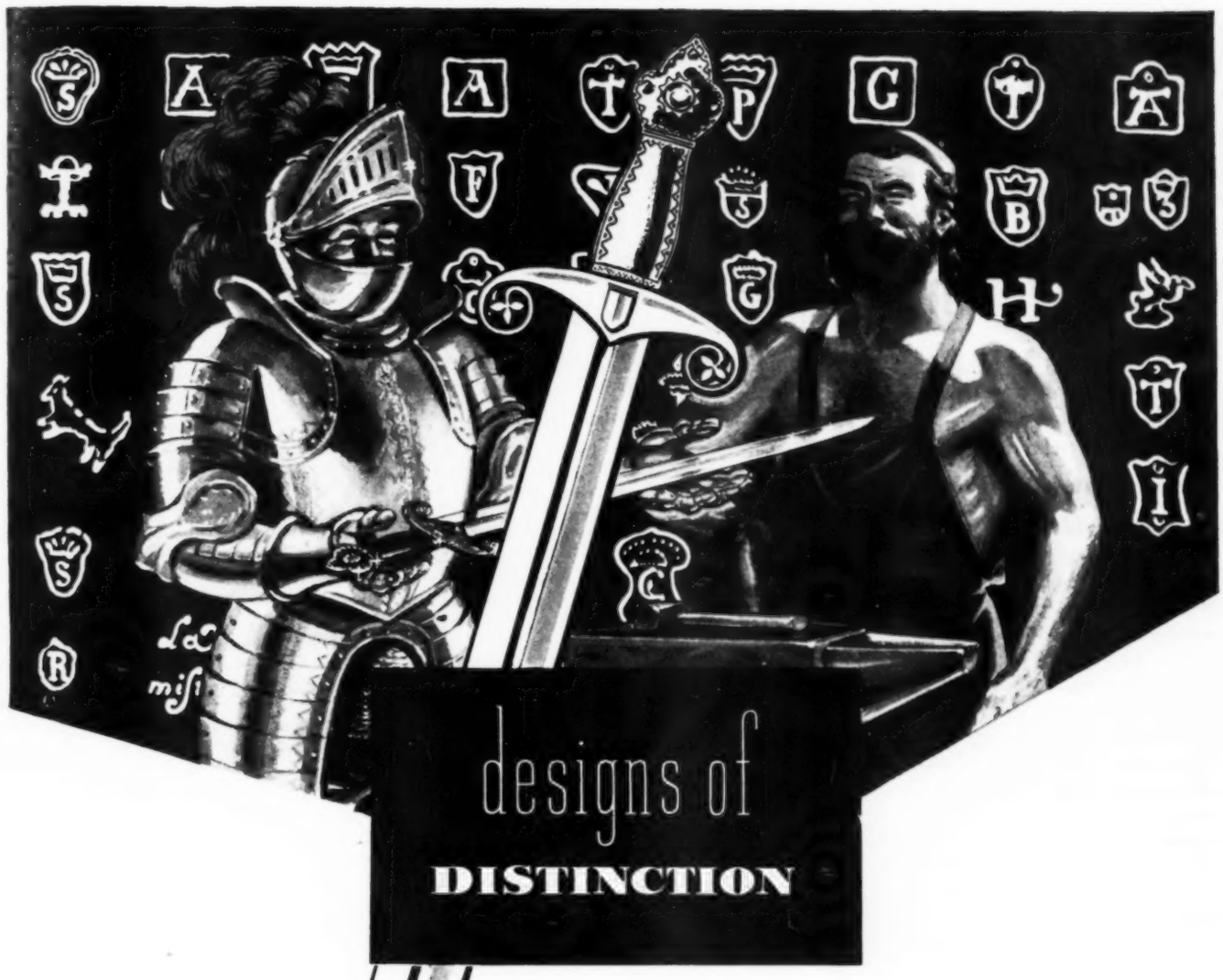
The Voltohmmeter Channel

The design of the voltohmmeter circuit, characterized by excellent stability and linearity, is principally that of the famous Junior VoltOhmyst, which has provision for high input resistance measurement of d.c. voltages in six ranges up to 1000 volts.

The ohmmeter section will measure up to 1000 megohms with only 3 volts of internally supplied d.c.

A new feature added to the VoltOhmyst circuit and introduced with the design of the Audio Chanalyst, is a diode circuit. This circuit is capable of measuring, throughout the audio spectrum, the r.m.s. value of a sine wave or 70.7 per-cent of either positive or negative a.f. peak of any magnitude up to 100 volts. The presence of odd harmonic distortion in a test signal can be ascertained by comparing opposite peaks in switching between a.f. + and a.f. — on the selector. The input impedance of the a.f. voltmeter with its cable will depend on the frequency which it is desired to use in making a voltage measurement; for 1000 cycles the impedance will be approximately 25,000 ohms with a shunt capacity of about 150 $\mu\mu$fd.

The diode is also shunt-connected and its emission current is balanced by a reversely connected similar diode in a circuit which produces linear output. For operation on the 500 and 1000-volt ranges, a two megohm voltage divider precedes the diode. While this arrangement does affect the above characteristics, it provides an extended range for low-frequency a.c. readings where it is practical to use an electronic voltmeter with its common ground connection.



designs of DISTINCTION

In medieval times discriminating knights journeyed to Toledo, Spain, to obtain hand-wrought blades of steel.

Only the famed guildsmen of Toledo could produce the flawless metal from which they fashioned graceful foils and swords of sleek beauty.

For hundreds of years these proud guildsmen stamped their guild marks or signatures on their creations.

A few firms today still preserve that spirit of craftsmanship. You find it in the plants of Detrola Radio. That is why the "guild mark" of Detrola Radio on a radio receiver, record changer or other electronic instrument is a guarantee of production quality. The world's finest merchants, and their customers recognize the value of this mark.

DIVISION OF INTERNATIONAL DETROLA CORPORATION DETROIT 9, MICHIGAN

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Hallicrafters S22R	74.50
Hallicrafters S39	110.00
Hallicrafters SX-25	94.50
Hallicrafters SX-28A	223.00
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RME-45 with Xtal, S Meter, speaker	166.00

Mail, phone, or wire your order. Demand may exceed supply for a few months. Reserve your receiver early. No priority required. No restrictions. You can send $5.00 and pay balance C.O.D. You can trade in your receiver. You can buy on terms. Write for full information. Tell us your wishes. We will help you get the best receiver for your use and will see that you are 100% satisfied. We also have a complete stock of amateur parts, transmitters, etc. Send to us for any amateur apparatus in any catalog or advertisement at the lowest prices shown. Your inquiries welcomed.

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The voltmeter, calibrated to read power output in decibels with controls set to read a.f. voltage, may be used as an output meter (Fig. 6). Decibel indications can be obtained with the Audio Chanalyst in two convenient ways—first, as a voltage ratio equivalent having no stated zero level (*i.e.*, a voltage gain of 3 to 1 equals a gain of 10 db. regardless of the actual input or output voltage); second, as a voltage or power gain referred to a given value, such as a defined zero level (*i.e.*, a 600-ohm line output may be 10 db. which means that the voltage measured across 600 ohms would be approximately three times the voltage given for the zero decibel value).

The Electronic Indicator

The electronic indicator channel consists of a 6E5 eye and its associated circuit components. The indicator has a high input impedance and may be used as a quick means of indicating the presence or absence of d.c. or a.c. voltages and their relative intensities. The indicator is not a voltmeter; it merely differentiates between high, medium, and low d.c. and will indicate the presence of a.c. (a.f.) voltages in a circuit by the shadow action of the magic eye.

The electronic indicator is ideal in checking amplifiers in which connections are doubtful, as in determining socket voltages of unmarked tubes, or in cases where it is desired to locate the presence of voltages up to 1000 volts. There is no danger of damaging meters and it is not necessary to switch ranges in making preliminary checks. The indicator should be the first choice when doubtful voltages are to be checked. It is truly a high-speed, fool-proof testing device!

Negative d.c. voltages may be checked from approximately —4 volts to —1000 volts. Voltages down to ½ volt or less will be indicated, although they are not always sufficient to close the eye completely.

With sufficient voltage to close the eye, it will remain closed as long as the probe is connected to the voltage source being checked. When the probe is removed, the shadow angle of the eye will slowly return to the normal ⅔-open position. The higher the applied voltage, the more slowly will the shadow return; the lower the voltage, the more rapid will be the return to normal (Fig. 7). By noting the time required for the shadow of the eye to return to its normal position, it will be possible to estimate the voltage value being checked.

Positive d.c. voltages are checked the same as negative, but the eye shadow, instead of closing, will open, thus indicating positive polarity.

As described above, a negative d.c. voltage causes the eye shadow to close and a positive d.c. voltage causes it to open. An a.c. voltage composed of alternate positive and negative peaks will, therefore, cause the eye shadow to swing in both directions. When a.c. or audio voltages of 4 volts to 1000 volts r.m.s. are applied to the probe, the eye will show a partial illumination over its entire reflecting area. The partial illumination is due to the *on* and *off* time of the a.c. voltage swing in either direction. Sine waves between 0 and 30 cycles will be indicated by their flickering and constant amplitude, while speech and music can be identified by the inconsistent flickering of the illuminated area.

The Speaker Channel

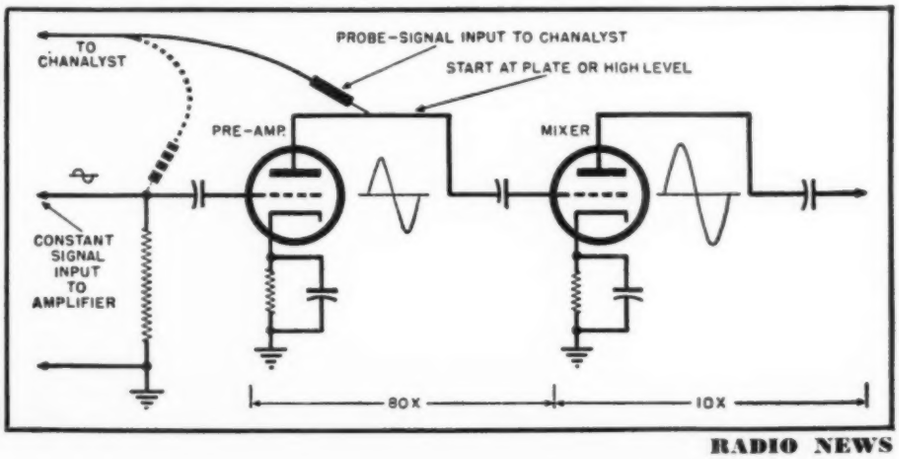
The speaker channel consists of a built-in electrodynamic speaker. The field acts as a choke in the power supply circuit of the amplifier and oscillator channels. Voice coil connections are made to the output transformer of the amplifier channel through the amplifier switch when the latter is in the *speaker on* position. The speaker may be used to monitor the output of the amplifier channel and to supply a sound-pressure field for microphone comparisons.

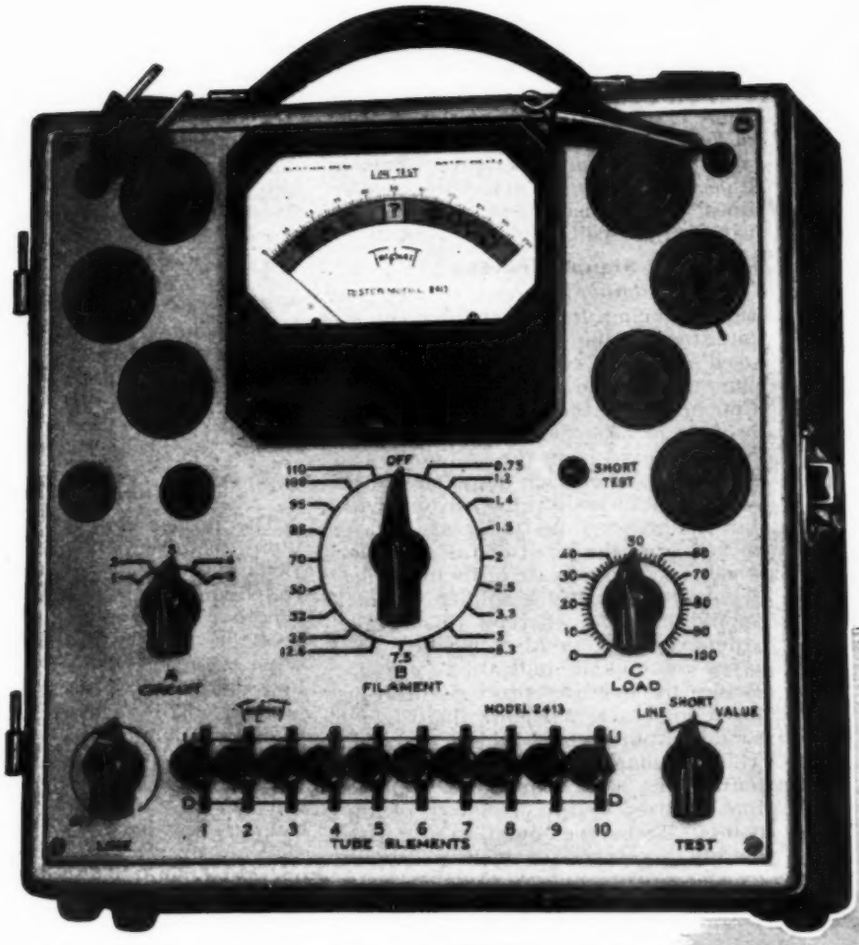
Speaker volume has been held at a low level by placing a series resistor in the voice coil circuit. This low level is purposely used to avoid speaker overloading, and to reduce the tendency of acoustic feedback when microphones are used in the vicinity of the Chanalyst.

Impedance Testing

Impedance checking is made rather easy by the substitution method, in which two principal sections of the

Fig. 11. The Audio Chanalyst may be used to check accurately the gain of any stage.





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MORE FLEXIBLE • FAR FASTER • MORE ACCURATE

Three-position lever switching makes this sensational new model one of the most flexible and speediest of all tube testers. Its multi-purpose test circuit provides for standardized VALUE test; SHORT AND OPEN element test and TRANSCONDUCTANCE comparison test. Large 4" square RED•DOT life-time guaranteed meter.

Simplicity of operation provides for the fastest settings ever developed for practical tube testing. Gives individual control of each tube element.

New SQUARE LINE series metal case 10" x 10" x 5½", striking two-tone hammered baked-on enamel finish. Detachable cover. Tube chart 8" x 9" with the simple settings marked in large easy to read type. Attractively priced. Write for details.

Additional Features

- Authoritative tests for tube value; shorts, open elements, and transconductance (mutual conductance) comparison for matching tubes.
- Flexible lever-switching gives individual control for each tube element; provides for roaming elements, dual cathode structures, multi-purpose tubes, etc.
- Line voltage adjustment control.
- Filament Voltages, 0.75 to 110 volts, through 19 steps.
- Sockets: One only each kind required socket plus one spare.
- Distinctive appearance with 4" meter makes impressive counter tester — also suitable for portable use.

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Yes, when you require speedy precision on intricate hard-to-reach jobs, you'll find a tip to fit the Ungar soldering pencil that will bring success. The ruggedly built Ungar soldering tool weighs only 3.6 ounces, is perfectly balanced and handles like a fountain pen. Length, 7 inches...heats in 90 seconds, draws only 17 watts and can take plenty punishment. Unit complete with any one tip sells for less than $2. Please order from your nearest Electronics distributor.
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Audio Chanalyst are combined by means of patch cables (Fig. 10). Impedance can be read directly by comparison with a built-in calibrated variable resistor when the electronic indicator is used to determine the identity of voltages across both the impedance and the calibrated resistor. This is especially helpful in matching speaker lines, line transformers, and in indicating choke-coil values.

Signal Tracing

The amplifier channel is used for signal tracing. In such tracing, the input stage of the channel section to be used should be comparable to that of the stage in the amplifier under test. Controls on the Audio Chanalyst should be adjusted so that a signal may be heard from the speaker. The gain controls of each stage should be set to the lowest level consistent with fair audibility. As the test lead is moved from the input of the amplifier under test to the plate of its first tube, the voltage in the amplifier channel should increase, thereby raising the volume at the Chanalyst speaker. This gives an audible indication of gain. Before the operator proceeds in probing along the signal path, the original sound output level should be restored. This is done by deducting approximately the same amount of gain as that realized by the change in pickup points. To balance out this gain, it is merely necessary to turn the input gain control to a lower level. If the signal is still too loud at its lowest level, the input cable plug can be transferred to the succeeding stage of the amplifier channel.

Gain Checking

Gain checking is essentially signal tracing plus an increased degree of accuracy. Gain measurements need not be based on actual voltages, but on relative values of increases or decreases in voltage change from a given input level. This is essential in localizing insufficient gain first discovered by signal tracing. It is seldom necessary to measure the gain of the entire amplifier to determine the point of gain deficiency (Fig. 11).

Monitoring Intermittent Operation

Intermittent operation of an audio amplifier may be attributed to a number of causes, such as defects developing spasmodically in tubes, resistors, and condensers in its circuit. This intermittent condition may be difficult to observe with ordinary test equipment because many of the usual tests will *cure* the intermittent condition temporarily while they are being made.

With the independent units of the amplifier channel connected to three different sections of the amplifier under test (Fig. 8), and with a constant signal applied to its input, each unit of the amplifier channel can be set to indicate any change in that signal. Any intermittent condition can then be isolated to that section of the amplifier in which a change in signal level is automatically indicated.

Any one stage or combination of the four stages of the amplifier channel may be used to *bridge* comparable stages of an amplifying system, either as a check to determine improper operation or as a temporary replacement for defective or inoperative stages. The procedure is generally a matter of substituting the stage of the amplifier channel that has sufficient gain to match the bridged section of the amplifying system. In most cases connections are made from the high-impedance output of the last satisfactory signal point in the defective amplifier, through the probe lead to the input jack of the amplifier channel used. The output of the amplifier channel is then connected to the input of the stage following the bridged section.

Tube Testing

The proper operation of any vacuum-tube circuit depends on the particular tube type that has been selected and the limitations of that type. Whether it be an amplifier, rectifier, inverter, mixer, discharge tube, or other, the functional use of the tube and its related circuit are inter-dependent. This suggests the possibility of making dynamic tube tests with signal tracing equipment or the electronic indicator. Any tube or its circuit can be quickly checked by these efficient testing devices.

As an example, the location of inoperative amplifier tubes can be determined by signal tracing to the point of failure which is invariably quicker than removing all tubes to test them separately. Replacement of a known good substitute tube, if available, is the fastest way to prove whether or not the original tube was defective. When a substitute tube is not available, the presence of a signal at both grid and plate of an amplifier tube will indicate that it is operative.

When weak tubes are suspected as a cause for a low output signal, the principles of signal tracing can again be used to determine, by comparison, the lack of gain in one or more stages. When a low gain, or loss, is encountered in any particular tube, causing doubt as to its operating efficiency, gain measurements will clear up the uncertainty.

Construction

The new Audio Chanalyst is the pride of its designers. It is ruggedly built to give long faithful service (Fig. 3). Convenience, too, is featured in the hinged-top chassis; all parts are instantly available by loosening two quarter-turn locking screws. The ohmmeter batteries can be replaced without removing the instrument from its case and, as all adjusting and calibrating controls are accessible through plugged holes in the case, the controls can likewise be reset without removing the instrument.

Applications

Any service engineer would balk at the idea of carrying a test instrument

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Key to the powerful N. U. merchandising plans that are now ready to go to work for service dealers—is the most striking package design in the radio parts field.

In this smart, modern, stream-line container, all N. U. branded products will be packaged—adding tremendously to their shelf-display and eye-appeal.

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A compact phonograph amplifier —ONLY one tube, but comparable to most 3-tube amplifiers. Built into sturdy metal chassis.

The amazing efficiency of this small amplifier will pleasantly surprise and satisfy you.

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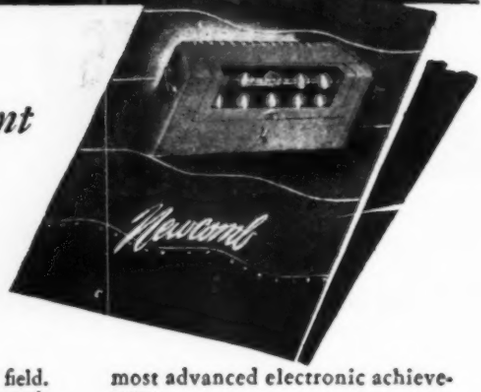
Quality sound equipment by Newcomb



PRESENTING our newest line of amplifiers... they offer you greater excellence in sound reproduction than has ever before been available to the public address field. Designed and produced by an organization devoted exclusively, for more than seven years, to the perfection of fine sound equipment, they embody all the practical benefits of today's most advanced electronic achievements.

Send for the catalog... compare Newcomb with others... you'll find no other amplifier has so many advantages.

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MANUFACTURERS

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as heavy as the Audio Chanalyst on every service job. It never was designed with any such intention. It was designed, rather, to fill a need for audio test equipment that would be very useful and efficient in solving problems in which the effectiveness of the usual smaller type instrument ceases. Factors such as the importance of the job, the nature of the trouble, the size of the installation, and the weight of the equipment, govern decisions as to the advantages of transporting component sections to a shop test-bench, or bringing adequate testing methods to the installation (Fig. 5). Common sense based on experience will soon indicate the better move. Some service engineers choose to keep an Audio Chanalyst in the car while they are on service trips, just in case they may need a compact test bench in emergencies or for difficult problems.

For sound equipment maintenance of large industrial installations, an Audio Chanalyst at the distribution center is highly desirable to insure a minimum of interruptions to the sound system arteries, which are constantly gaining in importance in their relation to production.

As time goes on, the sound men will probably show increased appreciation of being able to procure one instrument capable of testing everything from microphone to speaker. The Audio Chanalyst provides him with what is probably the first complete commercial test set, designed to meet the needs of his specialized business.

—30—

International Shortwave

(*Continued from page* 52)

ANKARA WANTS LETTERS

Radio Ankara, TAP, 9.465 (31.70 meters) was heard at 3:30 p.m. EST, Sunday, October 7, with its weekly feature, Postbag; excellent signals; announced they would be on at 4:30 p.m. EST, Sundays, thereafter, and would be heard to Great Britain at 3:30 p.m. each Monday and Thursday.

Radio Ankara opens and closes its Postbag radiation with oriental music. Answering a listener's question, TAP reported use of 20 kw. power. They will verify.

TAP is requesting reception reports, suggestions, and comments. "More and longer letters, with plenty of questions" are sought, they state. The address is simply Radio Ankara, Ankara, Turkey.

* * *

BBC'S NORTH AMERICAN SERVICE

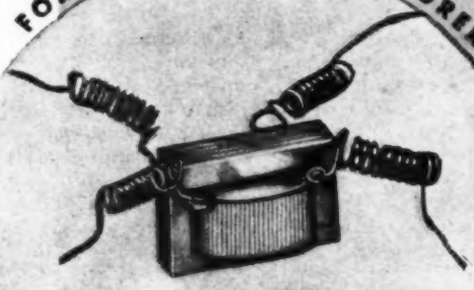
Several changes have recently been effected in the BBC's evening North American service, now scheduled:

To eastern North America, GSP, 15.31, 4:15-5 p.m.; GRG, 11.68, 4:15-9 p.m.; GRH, 9.825, GSU, 7.26, 4:15-11:45 p.m.; and GSL, 6.11, 9:15-11:45 p.m.

To western North America, GVZ, 9.640, 4:15-11:45 p.m.

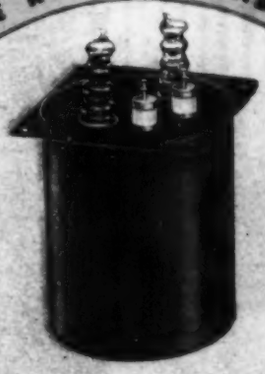
for every transformer application

FOR THE SET MANUFACTURER



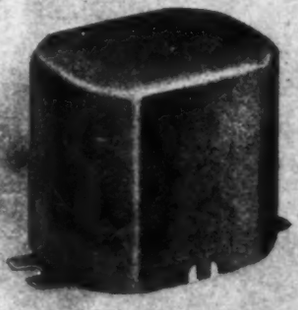
Miniature components to match the new "proximity fuse" miniature tubes. Output and input transformers, and reactors with dimensions 9/16" x 3/4" x 5/8".

FOR THE RESEARCH LABORATORY



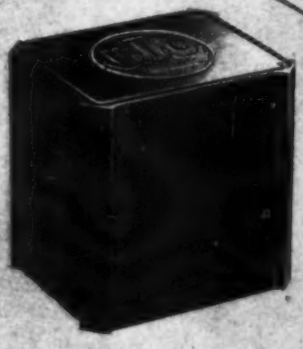
Typical of the special units produced by UTC is this high gain, 100 cycle, matching transformer. Primary impedance 500 ohms, secondary impedance 37,500,000 ohms, shielding suitable for—160 DB signal level.

FOR THE RADIO AMATEUR



UTC Special Series components cover the entire range of amateur and low priced PA requirements . . . attractively cased . . . economically priced.

FOR THE BROADCAST STATION



UTC linear standard transformers are the ultimate in high fidelity design . . . frequency response guaranteed ± 1.5 DB 20 to 20,000 cycles . . . Low wave form distortion . . . Extremely low hum pickup

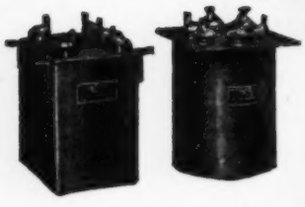
ALL PLANTS

United Transformer Corp.

150 VARICK STREET • NEW YORK 13, N. Y.

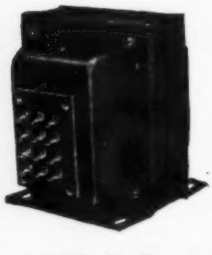
EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y., CABLES: "ARLAB"

TRANSFORMERS FOR POSTWAR ELECTRONIC APPLICATIONS



● Designed to meet your specifications, mechanically and electronically.

Open type, plastic impregnated transformers provide adequate weatherproofing for certain applications.



This special Radio Power transformer consists of primary winding, high voltage secondary winding and filament winding.

THE ACME ELECTRIC & MFG. CO.
CUBA, N. Y.

Acme Electric
TRANSFORMERS

To Africa, GWL, 7.205, 9:15-10:45 p.m.; and GVU, 11.77, 8:15-9 p.m. and 9:15-11:45 p.m.

Via Leopoldville, Belgian Congo, now on 9.745, directed to both Eastern and Western North America, 8:15-9 p.m. and 9:15-11:45 p.m.

English newscasts in this service are at 4:45, 5:45, 6:45, 7:30 (Radio Newsreel), 8:00, 9:00, 11:00 (Radio Newsreel repeat for West Coast), and 11:30 p.m.

BBC transmitters scheduled for the morning and afternoon North American Service include GSP, 15.31, 7-9 a.m., 9:15 a.m.-4 p.m.; GRG, 11.68, 2:30-4 p.m.; and GVQ, 17.73, 11-11:15 a.m.

Incidentally, the BBC expects to use additional special frequencies this winter for the West Coast in its evening North American Service. This was disclosed by Robert L. Thorp, BBC Engineer in New York, in a letter to August Balbi, Los Angeles, recently. Mr. Thorp also indicated that the Leopoldville transmitter will use two or more frequencies at the same time for better reception during the winter months. Mr. Balbi has suggested the use of a lower frequency such as 7-megacycles, since last winter the 9.78 frequency of Leopoldville faded out on the West Coast by midnight, EST, when the BBC could not be heard either direct or via Leopoldville. London often faded out by 11 p.m. EST even on the 7- and 6-megacycle bands last winter, Mr. Balbi reports.

* * *

REPORT FROM ENGLAND

From Darlington, Durham, England, Martin Harrison, formerly of British Columbia, writes that the Director of Foreign Broadcasts, FZI, Radio Brazzaville, French Equatorial Africa, is anxious to receive reception reports of FZI's transmission to North America at 5:15 p.m. on 9.440. The address is Poste National Francais, Brazzaville, French Equatorial Africa.

Mr. Harrison lists the following schedules of Radiodiffusion Francaise, Paris:

9.520—To North America, 7:55-10:45 p.m.; to Poland, 12:30-12:45 a.m.; to Germany, 4:30-4:45 and 3:30-3:45 p.m.; to Czechoslovakia, 3:45-5 p.m.

11.845—To North America, 7:55-10:45 p.m.; to Middle East, 12 midnight-12:15 a.m., 5-5:15 a.m., 11:30 a.m.-12:15 p.m.; to Poland, 12:30-12:45 a.m.; to Hungary, 1-1:15 a.m.; to Rumania, 10:15-10:30 a.m.; to Bulgaria, 10:30-10:45 a.m.; to Yugoslavia, 10:45-11 a.m.; to Italy, 11-11:15 a.m.; to Greece, 11:15-11:30 a.m.; to Germany, 3:15-3:30 p.m.; to Austria, 3:30-3:45 p.m.; to Czechoslovakia, 3:45-4 p.m.; to Guiana, 4:15-5;15 p.m.

15.240—To New Caledonia, 10-10:45 p.m.; to Middle East, 12-12:15 a.m., 5-5:15 a.m.; to Turkey, 4-4:15 a.m.; to

This chairside radio is one of the many new models of radio receivers now in production. A lamp or vase can be set permanently on top of this radio because the phonograph is contained in a compartment which slides to left or right, depending on where the radio is placed. The 7-tube radio has an 8-inch speaker with a Di-Fusa-Tone grill for equalized sound diffusion. The record changer handles twelve 10-inch records or ten 12-inch records. Album storage space is provided in the rear of the cabinet. This model is available in mahogany, bleached mahogany, and walnut. ECA Radio says that this is the first chairside model which can be conveniently serviced. When servicing is necessary the top is removed, exposing the entire chassis.

PREVIEW OF Rauland TELEVISION FOR THEATRES

Pictured at left is a television projection installation in a London theatre before the war, operated by Cinema Television Ltd., associated with Gaumont-British, Ltd., and Baird Television. RAULAND owns American rights to all present and future television patents and processes of these British pioneers, thus combining the most advanced television thinking of two continents, to bring the finest in revolutionary entertainment to the American Public.

Here it is . . . a preview of what the RAULAND Theatre Television Projection Equipment will look like. This product of many years of development, while not yet available, is now in daily operation in the RAULAND Laboratory-Theatre, projecting scenes *as they occur on a full size theatre screen.* Here, advanced refinements are being constantly added to ready this equipment for the time when Theatre Television will make its public appearance.

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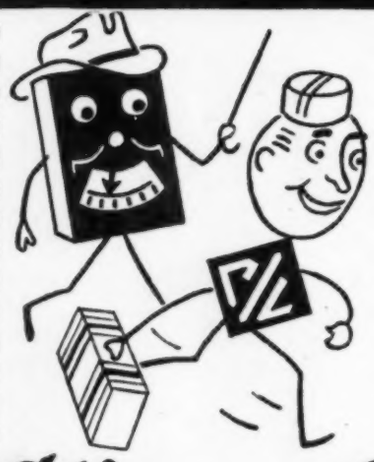

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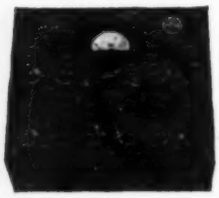

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North Africa, 5:30-5:45 a.m.; to Indo-China, 6-8 a.m.

11.730—To Tahiti, 11-11:45 p.m.; to various European countries, 10:15-11:30 a.m.; to Middle East, 11:30 a.m.-12:15 p.m.; to North Africa, 1:15-2 p.m.; to Belgium, same; to A.E.F., 2-3 p.m.; to Guiana, 4:15-7 p.m.

9.560—To Middle East, 12 midnight-12:15 a.m., 5-5:15 a.m.; to European countries, 12:30-1:15 a.m., 4-4:15 a.m.; to Indo-China, 6-8 a.m.; to Europe, 6-11:45 a.m.; to Poland, 12:15-12:30 p.m.; to England, 2-2:15 p.m.; to Europe 2:15-3 p.m.

9.620—To North America, 7:55-10:45 p.m.

17.765—To Indo-China, 6-8 a.m.

15.350—To Indo-China, 6-8 a.m.

Mr. Harrison listed the following schedules of Radio Brazzaville:

11.970—To France, 12 midnight-4:45 a.m., 50-kw., with rhombic aerials, and 4:45-8 a.m. with Chereix aerial; to Indo-China and the East, 11 a.m.-4 p.m.; to North and South America, 4-8 p.m.; English news at 7:15 a.m., 1:45, 3:45, 5:15, 6:30 p.m.

15.595—To Syria, the Near East, and the USSR, 4:45-5:30 a.m.; to In-

PENTODE vs. TRIODE OPERATION

By HERBERT S. BRIER

ANY receiver using a pentode or tetrode in the output stage can have its quality definitely improved at the cost of a new bias resistor, if it is not now necessary to run the volume control *wide open* for satisfactory output.

We all know that better quality can be obtained from class "A" triodes as output tubes, but we go on gaily using pentodes and tetrodes, because of their large output and high amplification factor. Actually, neither of these features is nearly as important as we sometimes think.

Let's compare a 6F6 connected as a pentode with the same tube connected as a triode. (These figures apply to 2A5's and 42's as well.) Assume a plate voltage of 250. An output of 3.1 watts at 8.5% distortion, with a peak audio voltage of 16.5 at the grid, is obtained with the pentode connection. The same tube, as a triode (screen grid connected to the plate), has an output of .8 watts at 6.5% distortion, with a peak audio voltage of 20 on the grid.

At first glance, the difference between 3.1 watts and .8 watts seems tremendous, but is actually only six db., which, in *ham* language, is just *one* "S" point. The slight additional voltage required on the grid simply means advancing the volume control a little more.

The question might arise whether a 2% reduction in distortion is worth bothering about. Definitely yes. Really, the improvement is more than this, because the distortion shown in the tube manual is measured across a pure resistance load—which no speaker is—in the plate circuit. And it is well known that changes of speaker impedance have much less effect on triodes than on pentodes.

The diagram shows how to make the changes; tie the screen grid to the plate, and change the value of the bias resistor.

"Ah," you say, "but the tube manual recommends a load resistance of 7000 ohms for the 6F6 as a pentode, and 4000 ohms as a triode. That means a new output transformer."

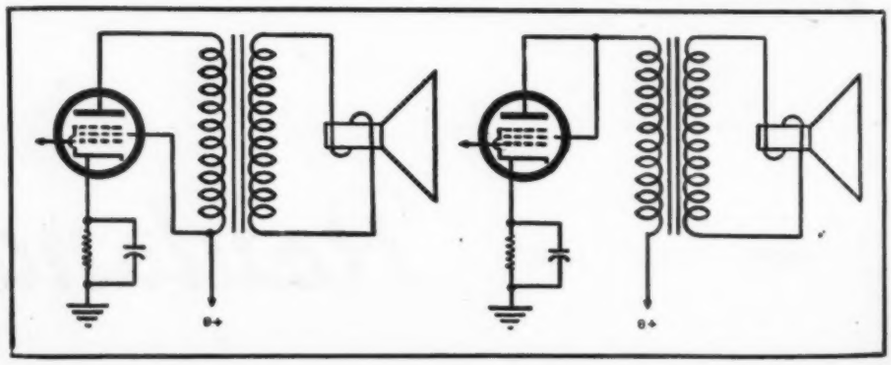
Luckily, this is not true; the higher impedance will reduce the output slightly, but it will reduce the distortion more. Using a triode-connected 6L6 in place of the 6F6 will give an output of 1.3 watts at 6% distortion, with the impedances almost perfectly matched.

Any of the other pentodes and tetrodes should work well under these conditions, if the voltage is held to the rated screen voltage, and the bias resistor adjusted so the total current does not exceed the rated current of the tube.

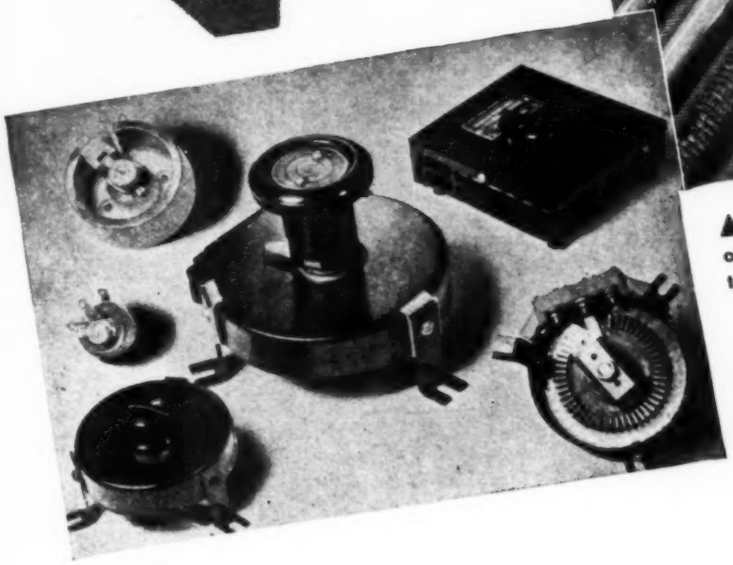
Impedances will be satisfactorily matched as long as the output transformer has a primary impedance of 5,000 ohms or more.

—30—

Method of converting a pentode connected tube to triode operation. The cathode bias resistor should be changed to 650 ohms for 6F6, 42, and 2A5, and to 480 ohms for 6L6 tubes.



VITROHM RESISTORS AND RHEOSTATS



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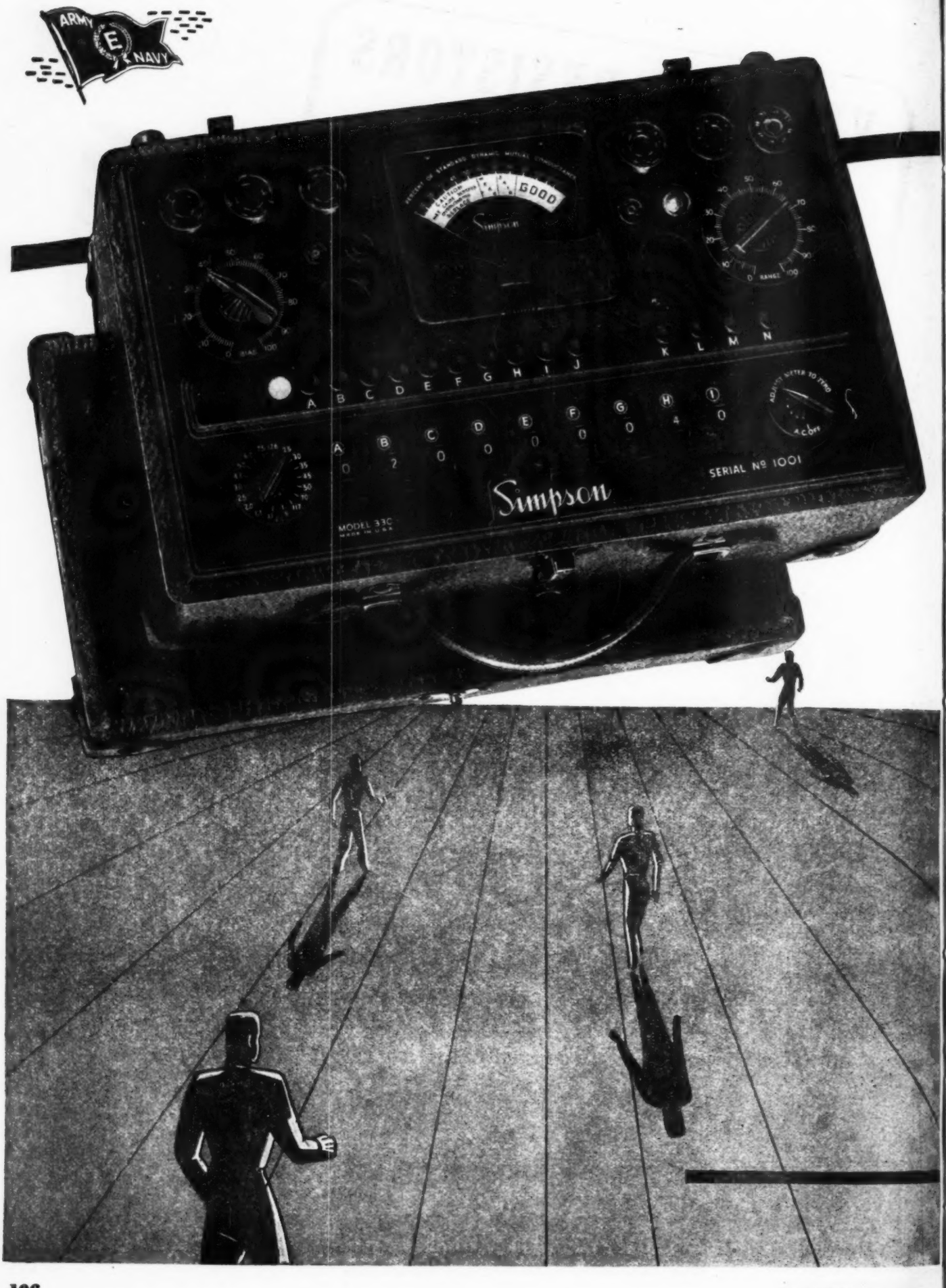
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MODEL 330
SERIAL Nº 1001

With this instrument a new era in tube testing begins

. . . Remember . . .

As you read below the many other features of this pioneering instrument, remember this: It is a Simpson instrument, with all that implies in creative engineering research, in controlled testing and manufacture. Simpson products are not "assembled", they are engineered and built in the Simpson plant. Practically every component part, from the dial and movement to the beautifully designed panels and the bakelite cases and panels, is made by Simpson. It is this that makes Simpson's the "instruments that *stay* accurate" with ideas that *stay* ahead.

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1. Size—15½" x 9½" x 6½".
2. Case—Sturdy plywood construction, with heavy fabroid covering, corners mortised in leather, rustproof hardware and removable cover with slip type hinges.
3. Panel—Heavy molded bakelite, beautiful satin grained finish. All characters, numerals, and dial divisions are engraved and filled in white, insuring long wearing qualities.
4. Meter—4½" rectangular of modern design with artistic four-colored dial indicating good, fair, doubtful, and bad —also "Percentage of Mutual Conductance" scale.
5. Sockets provided for all types of tubes with two spare socket positions.
6. Neon glow tube incorporated to indicate shorted tubes.
7. New simplified revolutionary switching arrangement (see description above).
8. The tube chart provided is arranged for quickly identifying the tube and setting the controls.
9. Tests tubes with voltage applied automatically over the entire operating range and under conditions approximating actual operation in a radio set.

Ask Your Jobber

The New Simpson Mutual Conductance Tube Tester Brings To Radio Servicemen and Dealers An Entirely New Method of Testing Tubes And A Revolutionary New Switching Arrangement!

Tube manufacturers consider that a radio tube has reached the end of its usable life when it falls to 70% of its rated value. Until now there has never been an instrument to test tubes in percentage terms.

But now here *is* such an instrument. The new Simpson Model 330 tests tubes in terms of percentage of rated dynamic mutual conductance—a comparison of the tube under test against the standard rated micromho value of that tube. The colored zones on the dial coincide with the micromho rating or the percent of mutual conductance, indicating that the tube is good, fair, doubtful or definitely bad. Thus, at a glance, you can check the tube against manufacturers' ratings. If, for any reason, it becomes desirable to know the actual value in micromhos, the percentage reading may be easily converted.

This is the way tubes should be tested—the way testers always should have worked—but Simpson is first again in bringing this needed development. It tests tubes with voltage applied automatically over the entire operating range, reproducing more completely than ever before the actual conditions under which a tube functions in a radio set. No instrument, not even delicately adjusted laboratory devices, can do this 100%. But this new Simpson Mutual Conductance Tester approaches perfection as never before.

Besides this revolutionary new method, Simpson offers you an equally revolutionary switching arrangement. The circuit is so arranged that, even though there are numerous combinations possible, very few switches require moving to test any one tube. Many of the popular tubes are tested in the "normal" position without moving any of the nine tube circuit switches.

Ten push button switches and nine rotating switches of six positions each provide infinite combinations in tube element and circuit selection. Only a few settings are necessary for the most complicated tube. The tube chart provided is arranged for quickly identifying the tube and setting the controls.

When you have finished a tube test, the Automatic Reset takes over to speed and simplify the next test. Just press the reset button and instantly all switches, both push button and rotary, return to normal automatically!

Here is the test instrument you have had a right to expect from Simpson. With greater flexibility in its circuit and switching arrangement than any other testes can provide, it gives maximum provision against obsolescence. It's the tester of a new era.

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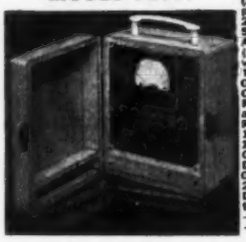

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"the heart of a good receiver"

do-China, 5:30-8 a.m.; news same as on 11.970.

9.440—To France, 11 a.m.-5 p.m., 12 midnight—5:45 a.m.; to North America, 5-6:45 p.m.; to South America, 6:45-8 p.m.; news same as on 11.970.

17.527—To Indo-China, 12 midnight-4:45 a.m.; to France, 4:45-5:30 a.m. and 5:30-8 a.m.; to South America, 11 a.m.-4 p.m.

Transmitters on 15.595 and 9.440 use 50-kw. power.

Radio Polskie, 6.115, Lublin, Poland, signs at 3:40 p.m. with a Communistic slogan; uses a woman announcer. News in English is heard at 3:30 p.m.

Mr. Harrison, who recently moved from Canada to England, has been using a friend's short-wave receiver occasionally since his arrival in Britain. He expects to get a receiver of his own early in the year, when we'll have some more of his fine reports.

* * *

NEW

A late flash from August Balbi, Los Angeles, indicates definitely that the station on 6.04 is Rangoon, Burma, heard with English news at 9 a.m.; good signal; and on 11.85 or 11.86, with English news at 9:30 or 9:35 a.m.; on 11.85-6, Radio Rangoon is on to 11 a.m. or later.

Radio National Belge, 17.845, Brussels, is reported with a fair signal, 6-7 a.m., broadcasting in French to Leopoldville; may have an announced transmission at 11 a.m.

CKEX, 11.90, Sackville, N.B., is reported testing, 3:45-5 p.m.

COBL, 9.833, Havana, Cuba, has returned to the air with good signals, 7:15 a.m.-11 p.m. This station was formerly COCM; relays CMCM.

HI8Z, 7.212, Santiago, Dominican Republic, reported testing 7-9 p.m.; fair to good signal.

Radiodiffusion Francaise, 11.845, Paris, is now being heard in parallel with 9.520 and 9.620, to North America, 7:55-10:45 p.m.; English news is at 9:30 and 10:30 p.m.

German stations reported relaying to the American networks are DHTN4, Berlin, 7:35 p.m.; DHTB, Berlin, and DHTB2, Wiesbaden, reported to operate on 8.135, 12.005, and 15.860; the latter reported with Armed Forces Radio Service programs, 11 p.m.-2 a.m.

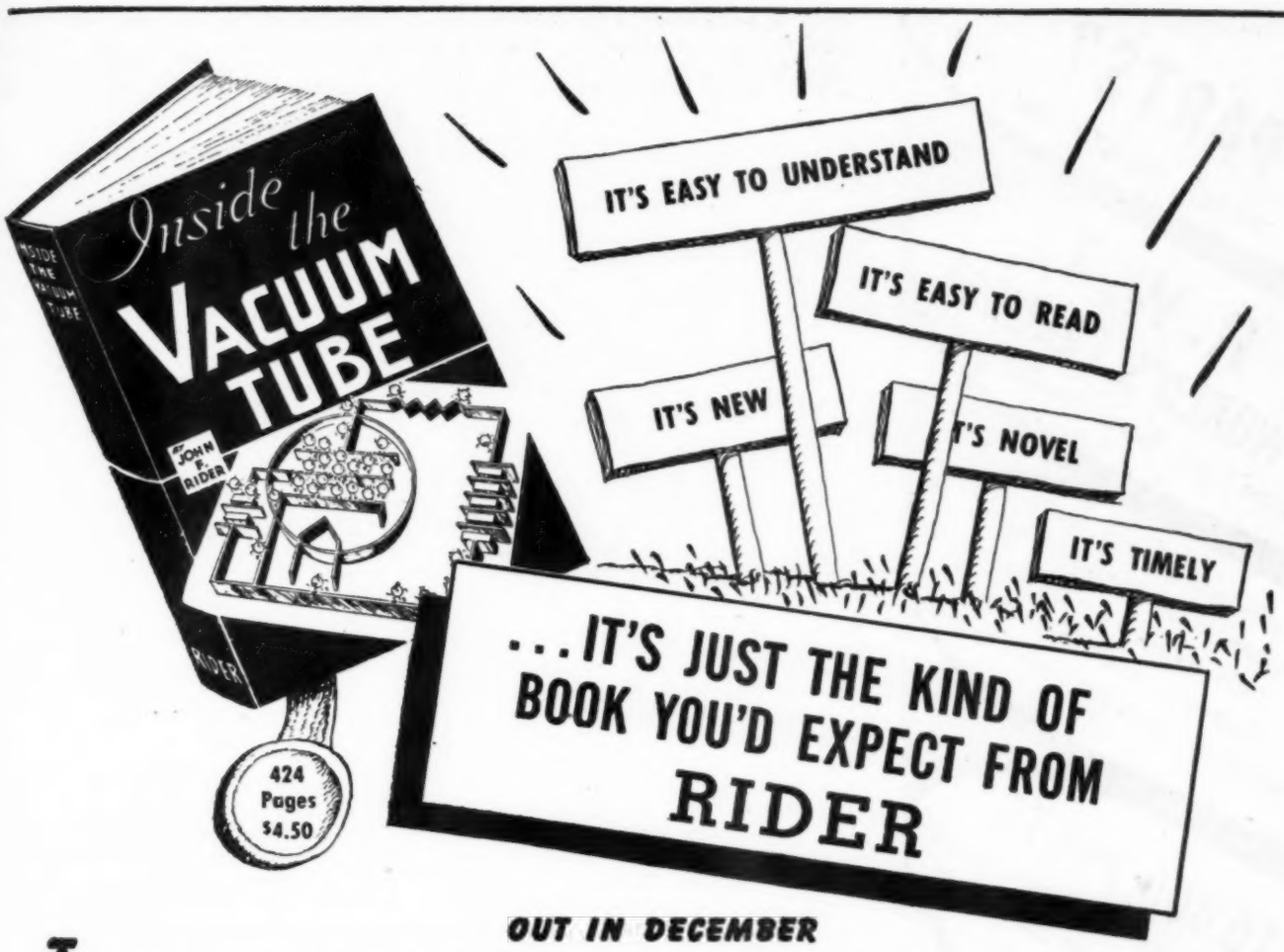
Reports continue to come in that ZL4, 15.280, Wellington, New Zealand, has been heard testing at 12 noon. ZLM5 (also reported as ZLN5), 15.500, of the New Zealand Post & Telegraph Department, has been reported testing irregularly since August 28, 10:30-11:02 p.m., strong signals.

YNBH, 7.008, Managua, Nicaragua, *Radio Panamericana,* reported, 6-10 p.m.

WVLC, 10.380, Manila, reported on this new frequency at 12:15 a.m.

Radio Portuguesa, 12.408, Parede, Portugal, reported 8 a.m.-4:30 p.m. with good signals, relaying CS2ZA; carries many Lisbon programs. (Harris, Mass.)

EDV10, 7.105, Madrid, *Radio Seu,* reported signing off with march at 6:25



OUT IN DECEMBER

This is not just another book on the vacuum tube, but a typical Rider Book, offering a new approach to the subject—presented with a technique that makes its message clear and easy to understand. Here is a solid, elementary concept of the theory and operation of the basic types of vacuum tubes upon which can be built more advanced knowledge.

After explaining the electron theory the text, presents a discussion on electrostatic fields, on the theory that the reader's understanding of the distribution and behavior of the fields within a tube will give him a better picture of why amplification is accomplished within a tube and how the grids and plates are interrelated.

To give a clear physical picture of its subject, the book employs novel physical devices. For example, certain diagrams and graphs are repeated, to reduce to a minimum the bother of turning pages back and forth to read text and drawings. Another innovation is the use of anaglyphs, "three-dimensional" pictures of phenomena heretofore seen only in two dimensions. Viewed through glasses supplied with the book, they are invaluable aids toward the rapid understanding of the text.

Although this is an elementary book on a fundamental subject, therefore a goldmine for the student; developments in radio and the new fields of television and microwaves make it a must for the libraries of servicemen, amateurs and engineers. Place your order today.

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p.m.; recently moved from 7.010; heard with fair to good signals, 3:30 p.m. to sign-off.

The Swiss transmitter on 15.875, heard 2:20-2:50 p.m. with English news at 2:20 p.m., is reported to use the call, HEK5. (Another source lists it as HER5.)

Paris can now be heard 6-6:45 a.m. on 15.350 and 17.765 in parallel with 15.240 and 9.560 to North Africa and the Near East.

ICD, 16.395, Rome, is being heard with point-to-point broadcasts around 8 a.m., frequently directed to New York.

* * *

CHANGES

The Voice of America in North Africa, 6.040, Algiers, was recently heard signing off at 5:30 p.m., relaying New York. This station is now scheduled 12:30-6 p.m., however. On 11.760, this North African transmits, 6 a.m.-1:30 p.m., and on 9.610, 1:45-6 p.m.

Radio France, 12.120, also in Algiers, has been heard to new sign-off at 5:30 p.m. This transmitter is reported to be relaying Paris to Europe, 3-5 p.m., followed by news and music irregularly to around 6 p.m. sign-off.

Radio Splendid, 3.430, Buenos Aires, Argentina, relays LRS to sign-off at 8 p.m. LRY1, 6.090, Buenos Aires, opens at 5:45 a.m. with good signals; 7-7:30 has news followed by American recordings.

Radio Vienna, Austria, is reported to be heard simultaneously on three transmitters, 12.125, 9.832, and 7.160, scheduled 12 midnight-2 a.m. and 1:30-8:30 p.m. The 12.125 transmitter is best, with 9.832 often buried under London.

Emissora National, 11.090, Ponta Delgada, Azores, is now being heard 2-3 p.m. instead of 1-2 p.m. as previously; signals are excellent in East.

Radio National Belge, 17.770, Leopoldville, Belgian Congo, is now heard, 4:30-6 a.m. directed to England; news at 5:45 a.m.; continues on the air to 8 a.m.; strong in East. In the 30-meter band, has returned to 9.745 from 9.765; there is still some QRM evenings from adjacent transmitters.

Radio Sofia, Bulgaria, recently moved to 9.300 from 9.350.

PRE9, 6.105, Fortaleza, Brazil, is reported using this frequency exclusively; was formerly also heard on 15.165; is heard to 9 p.m. sign-off. PRL8, 11.720, Rio de Janeiro, has a new schedule for the United States, being beamed northward, 9:30-9:55 p.m., Mondays to Fridays only.

CKRO, Winnipeg, comcs on the air at 9 p.m. after having left the air on CKRX, 11.720. CKRO signs off at 12 midnight with *God Save the King;* has a final news period at 11:45 p.m.

VE9AI, 9.540, Edmonton, Alberta, is now heard to 11 p.m. sign-off; news at 9 p.m.

With the call XGOO, 11.690, Shanghai resumed broadcasts on September 4 under Chinese control by the Central Broadcasting Administration, opera-

Sergeant Charles F. Deane, an AACS radio technician, has been burning the midnight oil at Sheppard Field, Texas, for the past six months. His long labors finally bore fruit recently when it was announced that he had assembled an ingenious "missing link" with forty dollars' worth of junk radio parts that will do the job of a complicated teletype terminal with a commercial value exceeding ten thousand dollars. His creation is actually the "missing link" between a radio receiver and a teletype printer. It is about one-tenth the size of a twelve-panel commercial terminal, weighing two thousand pounds. Deane's portable gadget weighs approximately fifty-five pounds. By employing electrical equivalents and by combining dozens of circuits (linear amplifier, limiter, two-chain detector, mark and space filter, etc.) it was possible to obtain a compact assembly. Deane's miniature model will print signals from any communications receiver. He has transcribed special BBC programs for British propaganda broadcasts and he is the experimental NCO of the 78th Continuation School at Sheppard Field.

GATES first made Radio Transmitting Equipment in 1922—centuries ago in terms of the youth of the entire Radio Industry.

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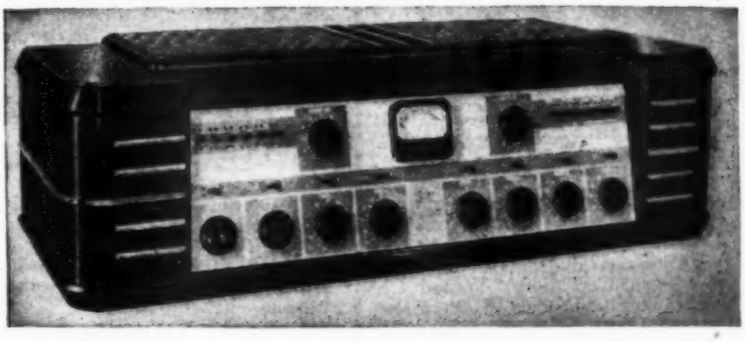

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PROGRESS REPORT

GATES is now in full production on civilian equipment and can make prompt delivery on many popular items.

EXCLUSIVE MANUFACTURERS OF RADIO TRANSMITTING EQUIPMENT SINCE 1922

MONTHLY

LEOTONE SPECIALS

Brand new R.C.A. No. 200 tubes in sealed cartons (ideal detector and amplifier) ..... 8 for $1.00

The following tubes in perfect condition, but not in sealed cartons. Guaranteed for 90 days.

Nos. 26, 27, 46, 56 and 6F6....each .29
6v6 GT tubes.....each .49
6SN7 tubes .....each .69
DeJur 3 stage Bakelite Chassis base wired for resistance coupled amplification, includes 3 sockets, 8 heavy duty binding posts and 6 metalized resistors 1.29
Western Electric platinum point telegraph keys .....each .49
Earphone head-bands, complete with forks .....each .59
Western Electric Platinum Point key and buzzer 1.75
Med. size battery clips 2½" long, ea. .06
One tube Mahler Battery set, includ. new No. 31 tube. Housed in wooden cabinet 7½x11x7½" deep (using 22 Volt B and 3 Volt-A battery)..... 3.95
Bakelite tubing—O.D. 3", length 2¾"; O.D. 2"; 2¾ length.....each .08
Isolantite base crystal detectors..ea. .69
Sliding Coil for Crystal set. (120 turns wound in 3" bakelite tubing)....each .69
Brass bar and slide for above...each .39
1" celotex 12x12 (specify size of hole) .....each .39
Double button mike transformer.... 1.25
Western Electric earphones model No. P-11 (2000 ohms) complete with phone plug 4.95
12" turntable felts.....each .23
10" General Industries turntable (⅜" shaft hole) .....each .98
12" General Industries turntable (⅜" shaft hole) .....each 1.25
8" Phono table (⅜" shaft hole) .each .98
⅓ Watt resistors uncoded. (Assorted values) .....50 for .39
Speaker cement, 1 oz.....per tube .19
Pi wound slip-over AC-DC primaries. I.D. ⅞" .....each .23
Cadmium plated 1" pully. ¼" shaft hole, ⅛" groove with set screws .each .10
3/16" Brown Linen Bakelite—7x10.. .59
7x7...45c 7x12...69c 12x12.. 1.20
Same stock as above cut to order.. .....per square inch .01
2½ Volt filament transformer (1½ Amp.) .....each .69
Earphone cushions .....each .19
New 4 and 5 prong tube bases, 4 for .10
Polymet tubular 1 mike 600 V condensers, paper wound 1"x2"....each .29
Westinghouse multiplier 150,000~ 1% plus or minus accuracy. Wound on bakelite bobbin. 1" O.D. ½" deep ..... each .39
Trim 2000~ earphones 1.75
Speaker Spider Kit ..... .35
Assorted Spiders for 4" to 12" Speakers (Dust-proof, Center Spider and Outside Spider)..... 3.25
Speaker Rosette Screws—8/32 thread —1¼" long .....per 100 .75

Write Dept. RN-12

LEOTONE

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* * *

LAST MINUTE TIPS

ZNS2, 6.092, Nassau, Bahamas, signs off at 10 p.m.; this station verifies; the address is P.O. Box 48.

Radio National Belge, Leopoldville, Belgian Congo, verifies; the address is Office de Radiodiffusion Nationale Belge. Is sending out a new card featuring views of transmitters.

From Europe comes a report that CHTA, 15.22, Sackville, N.B., is sending the strongest transatlantic signal of any short-wave transmitter in North America. The European transmission is scheduled, 6 a.m.-3:15 p.m.; has been heard testing to Latin America, 5:45-8:30 p.m. Also tests some evenings to the Pacific (New Zealand, Australia).

From Australia, it is reported that HVJ, 9.660, Vatican City, is being heard in English to 1:30 p.m.

VLQ, 7.240, Australia, reported coming on at 3 p.m. with domestic programs; fades around 5 p.m.

XPSA, 7.010, Kweiyang, China, reported back on the air, 5-10 a.m.

Weak signals are reported from FK8AA, 6.205, Noumea, New Caledonia, 3:30 a.m. to 5:05 a.m. sign-off; French news at 4:05 a.m.; much interference.

It appears that tests on ZLM5, 15.500, and ZLN4, 9.870, Wellington, New Zealand, are being made with two 5-kw. phone transmitters of the Post and Telegraph Department in order to collect data from the USA for the two new 7500-watt broadcasters which will soon take the air on a regular schedule. ZLM5 tests 2:15, 8, and 10 p.m.; ZLN4, 2:15, 4:15, 4:45, 5:45 a.m. These tests are scheduled for 15 minutes' duration, being relays of medium-wave 2YA and 2YC.

ZOJ, 11.810, Colombo, Ceylon, was heard in West Virginia during September and early October with a good to fair signal; has now faded out completely; has English news scheduled at

FCC NEWS

WITH the cessation of hostilities many of the amateurs in the armed forces evidently assumed that operation on the ham bands was once again permitted and proceeded to place the government rigs they were operating as their duty, on the 7 and 14 mc. bands. In a good many cases the amateur calls they had held back in the States were used. The FCC has logged over 358 cases of operation of this nature. Most of the violations observed were by stations in the far Pacific, as determined by DF equipment. There has also been some activity by stations operating in the European theater.

Such operation is in violation of regulations of the armed forces, FCC, and international treaty. Complete lists of all stations logged have been turned over to military authorities for appropriate action.

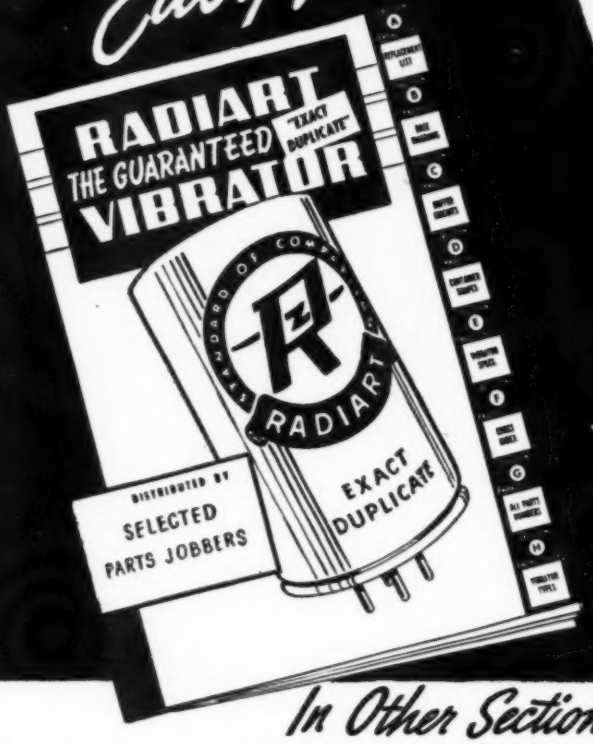
In a few cases these stations have actually communicated with United States amateurs in the States who have jumped the gun. The Radio Intelligence Division of the FCC has compiled sufficient evidence for prosecution in many of these cases and is ready to crack down. It certainly won't do the cause of amateur radio much good to have any more violations of this nature occur. As rapidly as possible the FCC is taking steps to see that hams may return to the air in the near been made and more are in the offing.

A recent case of an old offender, warned in 1939 on a similar offense, was the arrest in Cincinnati of a 39-year-old coppersmith, and father of seven children, for operating an unlicensed 112 mc. station. The RID in this case obtained the evidence of interference with interstate communication by setting up a receiver in Covington, Kentucky, just across the river from Cincinnati. The violator is being held to the grand jury for trial.

A similar station was recently tracked down in Boston. This station had worked with several amateurs in the Boston area and also had contacted an amateur working portable mobile in New Hampshire. In addition to this evidence, the RID had heard his signals with a receiver located in a lightship past the three-mile limit.

One of the biggest headaches of the RID is the policing done by well-meaning but misguided amateurs in the belief that they are helping to track down violators. In several cases these amateurs have used their own direction-finding equipment to locate violators and either warn or threaten them. Such actions have no legal status in court and in many cases serve to warn the violator and prevent his apprehension by law-enforcing authorities. Lay off, fellows! If you have

Makes Vibrator Servicing Easy!



MFRS. PART NO.
SERIES NO. SET MFR. YEAR MADE
RADIART NO.
BASE DIA.
LIST PRICE
BUFFER COND.
CAR MAKER
Section A...Vibrator
CHRYSLER
C1608 (Elec. P. B.) (Philco—1941).... 83-0027 5326P 3.00 A .005
25C6 (Wells-Gardner—1938)... 19A32 6437 5.95 AB .018
600 (Mech. P.B.) (Colonial—1941)... 43697 6301 3.55 A .004
601 (Colonial—1942). 911545 6301 3.55 A .004
800 (Philco—1941).... 83-0027 6326P 3.00 A .005

Every model listed includes all available data. The correct Radiart Replacement number and other essential information is determined instantly.

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B	3417	2	6	1⅜	4½	105		6
	3815	9	6	1¼	4½	105	Spec. Cup	6
C	5309	1	6	1½	2⅝	105		6
	5331	1	6	1½	3½	105		6
D	4256	1	6	1½	3¼	105		10
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In Other Sections..

Section "C"—Buffer Condenser Values and Circuits.

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SECTION "G"—

Radiart and Original Equ

Original Equipment Part No.	Radiart Rep. No.	Original Equipment Part No.	Radiart Rep. No.	Original Equipment Part No.
75	2253	1974	6301	8139
80-161	6421	2080	3417	6540
81D	6341M	2110	3417	6541
83-0017	5326P	2360	6413	6543
83-0025	5326P	2404	6340M	6601
83-0026	5326P	2501	6411	6602

Another Radiart Vibrator Guide EXCLUSIVE feature. When called upon to duplicate a vibrator and no information is available except the number on the old one, use this cross-index which shows the original manufacturer's number (as stamped on vibrator) and the CORRECT Radiart Replacement.

Auto Radio Service Dealers:

Obtain this Guide free of charge from your Radiart Distributor. Ask him to furnish you with a stock of the popular 12 types of Radiart Vibrators each of which is guaranteed to CORRECTLY service the applications listed for it in this guide. With these 12 types you can satisfy nearly all of the "Demand" types. But — RADIART is a *complete* line and your Radiart Distributor renders a *complete* service and can quickly furnish all of the necessary slower moving correct Radiart Replacement Vibrators as well.

Manufactured by the makers of RADIART Rust Proof Aerials.

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Write Dept. RN-12

LEOTONE RADIO CO.

MAKERS OF CONES AND FIELD COILS
65-67 DEY STREET, NEW YORK 7, N.Y.
WORTH 2-0284-5
12,000 SQ FT OF RADIO PARTS

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We continue to receive reports of unlicensed activity on the 112 mc. band. For some reason most of these violations have occurred on the West Coast. Several arrests have already been made and more are in the offing.

A recent case of an old offender, warned in 1939 on a similar offense, was the arrest in Cincinnati of a 39-year-old coppersmith, and father of seven children, for operating an unlicensed 112 mc. station. The RID in this case obtained the evidence of interference with interstate communication by setting up a receiver in Covington, Kentucky, just across the river from Cincinnati. The violator is being held to the grand jury for trial.

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Makes Vibrator Servicing Easy!

MFRS. PART NO.
SERIES NO. SET MFR. YEAR MADE
RADIART NO.
BASE DIA.
LIST PRICE
BUFFER COND.
CAR MAKER
Section A . . . Vibrator
Name, Model No.
Mfrs. Part Number
Radiart Number
List Price
Base Dia.
Buffer Condenser
CHRYSLER
C1808 (Elec. P. B.) (Philco—1941).... 83-0027 5326P 3.00 A .005
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Manufactured by the makers of RADIART Rust Proof Aerials.

Radiart Corporation

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Export Division
25 Warren St., New York 7, N.Y.

Canadian Office
455 Craig St., W., Montreal, Canada

NEW SOLDERING GUN

THE SPEED IRON*

Patent Applied For

100 Watts 115 Volts 60 Cycles

Soldering Heat in 5 Seconds

Wherever you have a soldered joint in radio, electrical or electronic repair and service work, the Speed Iron will do the job faster and better.

The transformer principle gives high heat—in 5 seconds—after you press the trigger switch. Convenient to hold with a pistol grip handle, the compact dimensions of this new soldering tool permit you to get close to the joint. The copper loop soldering tip permits working in tight spots. The heat is produced by the high current flowing through the soldering tip—permitting direct and fast transfer to the soldered connection.

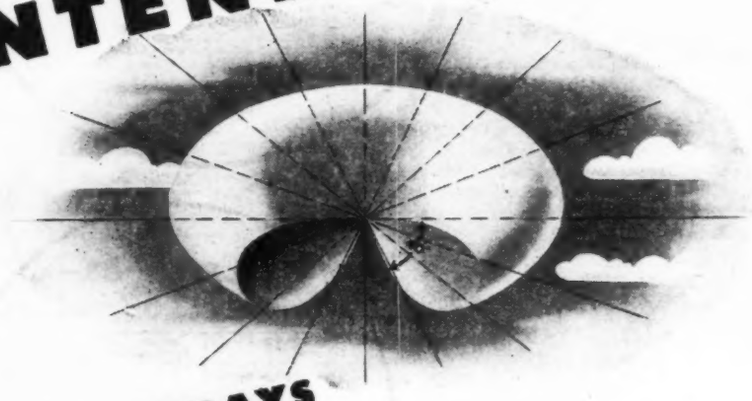
If you want to save time on soldering jobs with a tool that is ready to use in 5 seconds, get a Speed Iron today. See your radio parts distributor or write direct.

*T.M. Reg. U. S. Pat. Off.

WELLER MFG. CO.

DEPT. RN-1 • EASTON, PA.

ANTENNAS



BEACON ARRAYS

The design of a beacon array necessary to produce a predetermined pattern involves many factors not easily reconciled to each other. The exacting techniques developed at the Workshop during the war for readily controlling these factors makes it possible for us to meet the most rigid specifications. Manufacturers who require beacon arrays, or any other type of antenna to operate in the high frequency spectrum—from 30 mc up—will find our exceptional measurement and test facilities well-adapted to a quick solution of their problems. Just write, or phone the details.

The WORKSHOP ASSOCIATES

Antenna Manufacturers **FOR THE ELECTRONIC INDUSTRY**

64 NEEDHAM STREET, NEWTON HIGHLANDS 61, MASSACHUSETTS

7:30, 9:30, 11:30 a.m. Australia has been heard widely of late, identifying as "Radio Australia." Still sends fine signals to East in many periods of transmission over several transmitters. XGOY, 9.810, Chungking, is heard each morning, best around 7 a.m.; much CW QRM. SBT, 15.155, Stockholm, Sweden, sends an excellent signal, 10-10:55 a.m. TGWA, 9.790, Guatemala, is heard with good signals afternoons; fine musical programs. WVLC, 9.295, Manila, operates on 5 kw. power. All-India Radio on 9.59 has a good signal in English news period, 7 a.m.

A recent Saturday afternoon JCKW, 7.220, 41.55 meters, was picked up, testing; played popular recordings; English used; asked for reception reports; excellent signals, but late in afternoon there was much CW QRM. Was heard to 6:30 p.m., but believe it tests regularly each Saturday at 2:30-7 p.m. This station is located in Jerusalem, Palestine.

A station announcing as NCBL was heard a recent Sunday at 9:15 and 11 a.m. on 15.595, announced, calling New York on 14.800; perfect signal.

The BBC has announced a change in its Pacific Service, new schedule being 12:45-4 a.m., using same frequencies as before. Radio Dakar, 7.21, heard 2:15-2:30 a.m. with French news; strong. JLP, 9.605, Tokyo, relaying AFRS, is "operated by the Japanese, but supervised by the U. S. Army," according to a story told by station JLS to U. S. networks. The Armed Forces Network station, 6.08, Paris, is heard on West Coast with good signal after midnight. XGOO, 11.69, Shanghai, has POW messages daily at 9:30 a.m.; the signal from XGOO is holding up well. seems to have added more power.

From Gilbert Harris, North Adams, Massachusetts, comes: SUV, 10.055, Cairo, Egypt, heard at 3:06 p.m. recently calling GB2, London. Radio Centre, Moscow, 11.635, heard a recent Saturday at 12 noon-12:10 p.m. with English news. At 11 a.m., Moscow on 15.75 has a signal as good as any high-powered U. S. transmitter. Stations heard at 3 p.m. a recent Sunday, transmitting in French, may have been FXE, 8.020, Beirut, Lebanon, and CNR, 8.035, Rabat, Morocco. A station on 9.360, believed to be Cetinje, Yugoslavia, *Radio Cetinje*, was heard from 1:30 p.m. to sign-off at 2:58 p.m.; a man and woman were reading alternately a list of names and addresses. CBFX, 9.630, Montreal, Quebec, Canada, heard relaying CBCF at 12 noon. CSW7, 9.740, Lisbon, Portugal, heard 7-8 p.m.

* * *

BEST BETS FOR BEGINNERS

Mrs. John M. Hart, Anderson, Indiana, sends along these Best Bets:

PRL8, 11.720, Rio de Janeiro, Brazil, 9:30-9:55 p.m., Mon. to Fri., in English; excellent; HCJB, 15.100 and 12.445, Quito, Ecuador, excellent at 6 p.m. Radio Nacional de España, 9.370, Madrid, heard in English at 3 p.m. RNF, Paris, 9.520 and 9.620,

SYLVANIA NEWS
RADIO SERVICE EDITION

DEC. *Published by* SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1945

SYLVANIA "LOCK-IN" ADVERTISEMENTS SELL THIS SUPERIOR TUBE TO NATION'S MILLIONS

A large, attractive, three-color display banner featuring the phrase "Complete Radio Service" is now ready for distribution to servicemen by Sylvania.

The banner measures 46 by 28 inches, is printed in black, green and white on special weather-proofed "duckine" material, making it suitable for use either inside or outside of the store. It has six metal grommets to provide extra reinforcement.

This useful, durable and attractive display banner may be obtained for only $.40—or three for a dollar—from your local Sylvania distributor, or by writing to me at Sylvania Electric Products Inc., Emporium, Pa.

This banner is only one of the items on an extensive list of Sylvania promotional material designed to help servicemen merchandise both their own service and Sylvania radio tubes.

YOUR NEXT RADIO NEEDS "LOCK-IN!"
"PROVED IN RADAR! BEST FOR YOUR SET!"
LOOK FOR LOCK-IN TUBES BEFORE YOU BUY A RADIO:
Why? Because more than any other tubes, Lock-ins are in step with the trend in modern radio—a trend toward higher and higher frequencies.
Proved in Radar and secret radio equipment—Lock-ins are perfect for FM and Television.
Be sure your next radio is truly up-to-date! Look for Lock-ins!
"PERFECT FOR EVERY TYPE OF RADIO!"
"TOPS FOR FM AND TELEVISION!"
"DEFIES JAMMING—STATIC PUFF!"
SYLVANIA ELECTRIC
Executive Offices: 500 Fifth Ave., New York 18, N. Y.
Makers of Radio Tubes; Fluorescent Lamps, Fixtures, Wiring Devices; Electric Light Bulbs; Electronic Devices

Servicemen will find even more people asking about the war-famed Sylvania Lock-In Tube—because of big, full-page Lock-In advertisements appearing in eight national magazines. These ads are telling over ten million people that Lock-Ins have advantages possessed by no other radio tube.

Lock-Ins are noted for their electrical efficiency and rugged durability. Element leads are brought directly through a low-loss glass header to become sturdy socket pins—effecting a much desired reduction in lead inductance and inter-element capacitance. Support rods are stronger and thicker. There are fewer welded joints and no soldered joints.

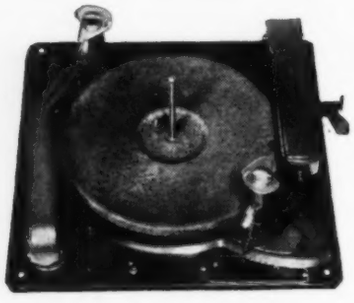
These remarkable tubes are designed and built to handle the high and ultra-high frequencies of FM and Television—as well as the lower frequencies. Today, set-manufacturers are looking to the Lock-In Tube as the perfect electronic unit for all new radios.

SYLVANIA ELECTRIC

Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS

UP FRONT... Every Time



Combination record-changer recorder Model GI-RC130

You'll like our postwar line of *Smooth Power* motors, recorders and combination record-changer recorders. They are right up in front with high-quality, velvety smooth operation, perfect fidelity in recording or reproduction.

They have the same fine design and built-in qualities that deliver complete satisfaction, as always. There is no skimping of details to give us fast production. You'll have a front seat in the postwar markets with General Industries phonograph mechanisms.

THE GENERAL INDUSTRIES CO.
Dept. M • Elyria, Ohio

THE GENERAL INDUSTRIES COMPANY
Smooth Power

heard with strong signals, 9:30 p.m. HEF4, 9.185, Bern, Switzerland, has a very good signal in its English radiation, *Switzerland Calling America*, daily except Saturday, 8:30-10 p.m. Radio Centre, Moscow, 15.750, heard with strong signal, 11-11:30 a.m. Radio Brazzaville on 17.530 heard with strong signal in English news at 1:45 p.m. and on 9.440 at 3:45 p.m.

For beginners on the Pacific Coast, Robert N. Morris, Portland, Oregon, suggests these Best Bets:

VLA, 7.280, Melbourne, Australia, 8:30-10 a.m.; English news at 9, 9:15, and 9:35 or 9:30 a.m. Radio France, 9.520 and 9.620, 7:55-10:45 p.m., with English news at 9:30 and 10:30 p.m., verification received. CHTA, 15.22, Sackville, N.B., 7:30-11:30 a.m., verification received. XEBR, 11.820, Hermosillo, Sonora, Mexico, 9 a.m.-12 noon, verification card received. VLC6, 9.615, Shepparton, Australia, 9-10:45 a.m., news at 9:15 a.m., verification received. KU5Q, 15.900 and 12.280, Guam, heard irregularly after 5 p.m. in English, verification received. XGOA, 9.730, Chungking, China, 5:40-10:15 a.m., in Chinese and English with English news at 9 a.m., verification received. KRHO, 6.120, Honolulu, Hawaii, 4-9:55 a.m., English news on the hour, good signal, verification received. KU5Q, 12.250, and 15.920, Guam, on the air at 9 p.m. in English, good signal, verification received. PRL8, 11.720, Rio de Janeiro, Brazil, 9:30-9:55 p.m., Mon. to Fri., with English news at 9:30 p.m.; strong; will not verify.

* * *

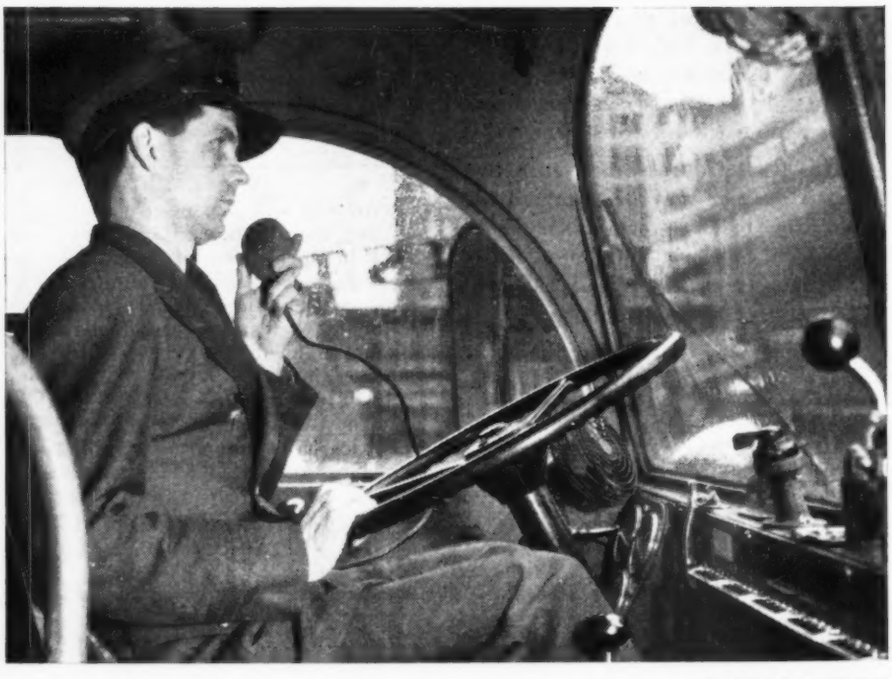
ACKNOWLEDGEMENTS

Excellent reports are being received. Please keep them coming in around the first of each month. Our especial thanks go to:

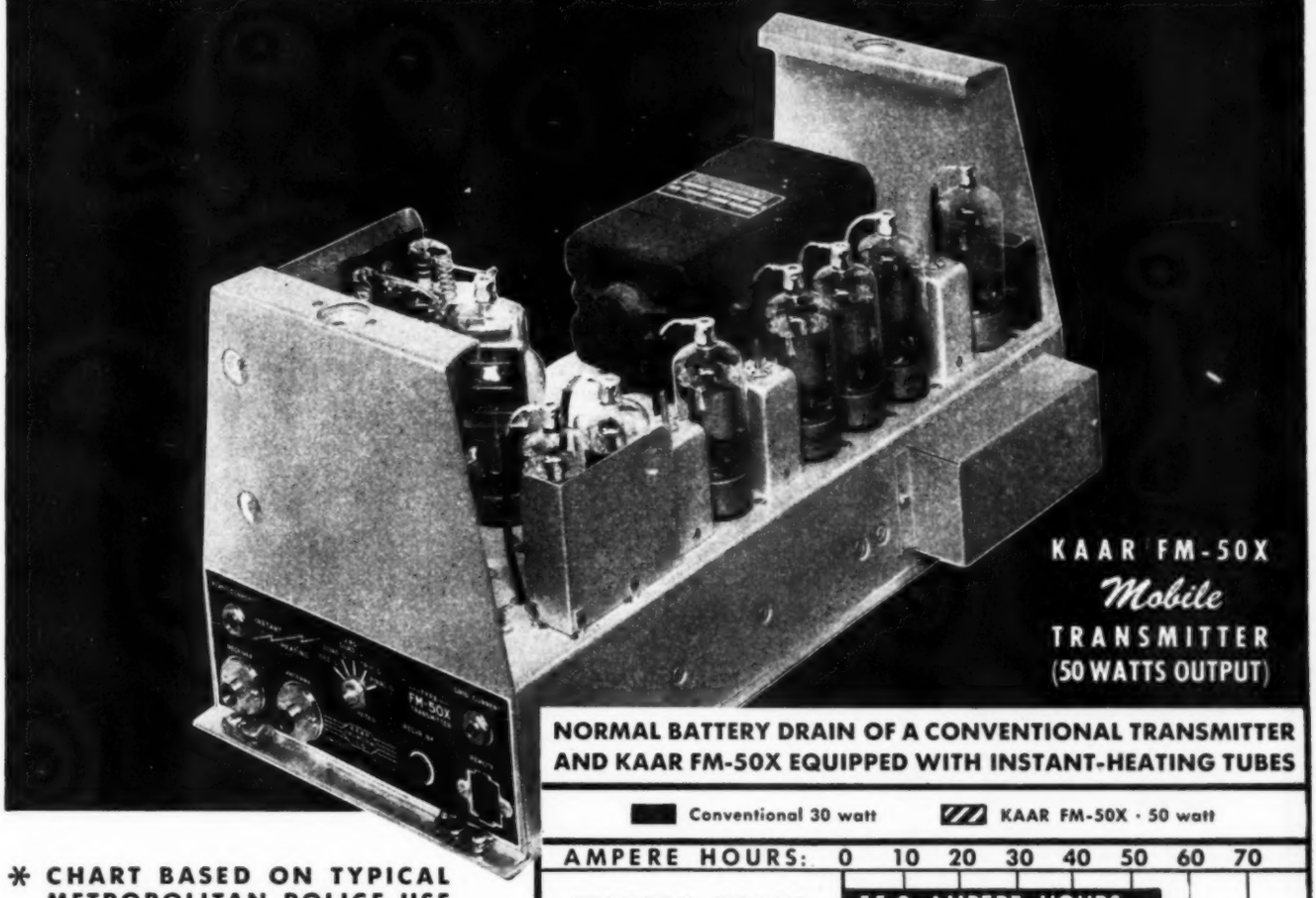
AUSTRALIA—Maher, Gillett; CALIFORNIA—Balbi, Dilg, Foster, Curtiss; CANADA—Bromley, Ontario; Kennedy, Nova Scotia; DISTRICT OF COLUMBIA — Harris, West Indian Radio Newspaper; Royal Norwegian Information Service; Netherlands Information Bureau; ENGLAND—Harrison; ILLINOIS—Johnson, Gutter; INDIA — Wadia; KANSAS — Steinmetz; MASSACHUSETTS — Harris, Forsberg, Kernan, Florentine, Horton; MISSOURI—Kierski; NEW JERSEY —Potts, Newark News Radio Club; NEW YORK—Bogdan, BBC, Consulate General of Ireland; French Press & Information Service; Australian News & Information Bureau; NEW ZEALAND—Milne; OHIO—Sutton; OKLAHOMA—Brewer; PENNSYLVANIA — Black; TEXAS—Freund; VIRGINIA—Howe, URDXC; WASHINGTON—Brott, Hanson; WEST VIRGINIA—Gonder.

-30-

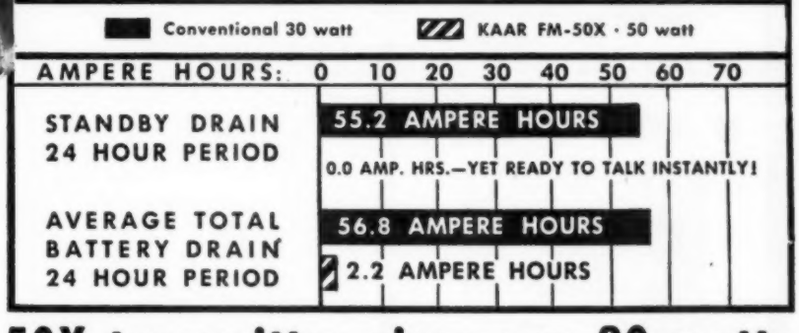
Two-way radiotelephone is being tried out in Chicago by Greyhound Lines. The equipment is that of Motorola-Galvin and uses FM-type transmission in the 30-44 mc. band. One of the reasons advanced for the use of radiotelephone is the fact that a bus, like the airplane, once having left the depot is usually unreported until its arrival at its destination. During the interim, much can happen. The function of the radiotelephone being carried aboard is mainly to report its location, that everything is going okeh, and that the schedule set for it will be met. Such information, received in time, will permit revision of other and connecting schedules to be altered to meet unusual conditions, as well as to send out assistance if a highway breakdown should occur. Photograph shows simulated radiotelephone operation by the bus driver. To transmit, or talk to the base station, or to another bus, he picks up the microphone, depresses a button on the case. To listen, he merely releases the same button and hears the answer in a loudspeaker which is mounted directly behind him. He has no adjustment to make other than the volume or the level at which the received signal turns on the loudspeaker which is "dead" until a signal turns it on.



Compare the actual battery drain!*



NORMAL BATTERY DRAIN OF A CONVENTIONAL TRANSMITTER AND KAAR FM-50X EQUIPPED WITH INSTANT-HEATING TUBES


Conventional 30 watt
KAAR FM-50X · 50 watt
AMPERE HOURS: 0 10 20 30 40 50 60 70
STANDBY DRAIN 24 HOUR PERIOD
55.2 AMPERE HOURS
0.0 AMP. HRS.—YET READY TO TALK INSTANTLY!
AVERAGE TOTAL BATTERY DRAIN 24 HOUR PERIOD
56.8 AMPERE HOURS
2.2 AMPERE HOURS

*** CHART BASED ON TYPICAL METROPOLITAN POLICE USE**

(140 Radiotelephone-equipped cars operating three shifts in city of 600,000 population.)

MESSAGES ORIGINATED BY CARS	904
MESSAGES ACKNOWLEDGED BY CARS	932
TOTAL TRANSMISSIONS PER CAR	13
AVE. LENGTH OF TRANSMISSION	15 sec.
AVE. TRANSMITTING TIME 24 HOURS	3 min. 15 sec.

KAAR mobile FM-50X transmitter gives you 20 watts more output with only 1/25th usual battery drain!

KAAR engineers—who pioneered the instant-heating AM radiotelephone—have now, through the use of instant-heating tubes, made 50 and 100 watt *mobile* FM transmitters practical! Thus you gain greater power and range—along with a tremendous reduction in battery drain!

With instant-heating KAAR equipment standby-current is zero—yet the moment you press the button microphone you are on the air. Contrast this with conventional emergency transmitters, over 90% of which operate with the filaments "hot" during stand-by. Since sturdy instant-heating tubes eliminate this great waste of energy without slowing the handling of messages, KAAR 50 and 100 watt transmitters can be operated from the standard ignition battery!

100 WATT MOBILE FM!

The KAAR FM-100X is identical to the FM-50X, except for the final amplifier. It puts 100 watts into a standard 34 ohm non-inductive load and is ideal for county and state police use. It requires no special batteries, wiring, or generator changes.

ADDITIONAL FEATURES

A new system of modulating the phase modulator tubes in KAAR FM transmitters provides excellent voice quality. Note that the equipment is highly accessible, and only two types of tubes are used. Frequency range: 30 to 44 megacycles.

Write today for free bulletin describing KAAR FM transmitters in detail. It's ready now!

KAAR ENGINEERING CO.

PALO ALTO CALIFORNIA

Export Agents: FRAZAR AND HANSEN · 301 Clay St · San Francisco, Calif.

HERE! BRAND NEW
RECEIVERS and TRANSMITTERS
Write SREPCO today
for • EARLY DELIVERY
• EASY TERMS
• LIBERAL TRADE-IN

HALLICRAFTERS

RECEIVERS SX28A
S20R SX25 S22R
TRANSMITTERS
HT4E HT9 HT6

HAMMARLUND

SUPER-PRO HQ129X

NATIONAL

NC240C HR05
NC46 SW3U
ONE-TEN

RME

RME45

TEAR OUT AND MAIL TO
SREPCO
STANDARD RADIO & ELECTRONIC PRODUCTS CO.
135 EAST SECOND STREET · · · DAYTON 2, OHIO

☐ Please send me information on delivery of

☐ Please send me information on Easy Terms

Name

Address

City State

Shortwave Broadcasts

(*Continued from page 53*)

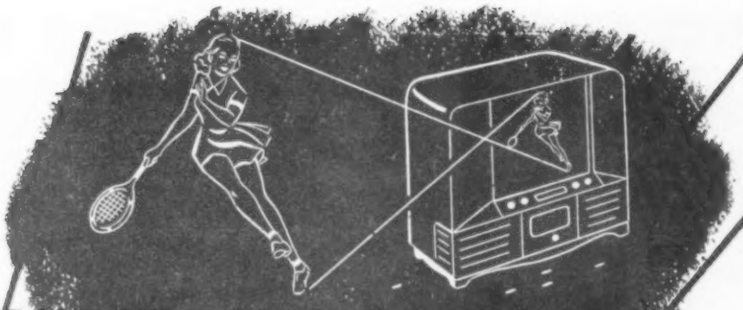
EST	LOCATION	CALL	FREQ.*
7:30 p.m.	London (RN)	GRG	11.680
		GVZ	9.640
		GRH	9.825
		GSU	7.260
		GSD	11.750
		GSB	9.510
		GRJ	7.320
		GSC	9.580
	(Via Georgetown, British Guiana)	ZFY	6.000
7:45 p.m.	Lahti, Finland	OIX4	15.190
8:00 p.m.	Moscow		9.480
			15.750
8:00 p.m.	Honolulu	KRHO	17.800
8:00 p.m.	London	GRG	11.680
		GVZ	9.640
		GRH	9.825
		GSU	7.260
		GSD	11.750
		GSB	9.510
		GRJ	7.320
		GSC	9.580
		GRR	6.070
	(Via St. Johns, Newfoundland)	VONH	5.970
8:10 p.m.	Leopoldville	RNB	9.745
8:30 p.m.	Port Moresby, New Guinea	VIG	15.080
8:30 p.m.	Delhi	VUD5	11.790
8:45 p.m.	Delhi	VUD8	15.350
8:45 p.m.	Bern	HEF4	9.185
(or 8:35 p.m.; except Sat.)		HEK3	7.380
9:00 p.m.	Vancouver	CBRX	6.160
9:00 p.m.	Edmonton, Alta.	VE9AI	9.540
9:00 p.m.	Honolulu	KRHO	17.800
9:00 p.m.	London	GSU	7.260
		GVZ	9.640
		GRH	9.825
9:30 p.m.	Paris	RNF	9.520
			9.620
			11.845
9:30 p.m.	London	GSW	7.230
		GSD	11.750
		GSB	9.510
9:30 p.m.	Melbourne (Shepparton)	VLC4	15.315
		VLG3	11.710
9:30 p.m. (Mon. to Fri.)	Rio de Janeiro	PRL8	11.720
9:45 p.m.	Delhi	VUD5	7.275
		VUD2	7.290
10:00 p.m.	Colombo, Ceylon	ZOJ	15.275
10:00 p.m.	Honolulu	KRHO	17.800
10:30 p.m.	Delhi	VUD5	15.190
		VUD6	11.830
		VUD9	11.870
		VUD7/10	15.160
		VUD3	15.290
		VUD10	17.830
		VUD8	15.350
10:30 p.m.	Paris	RNF	9.520
			9.620
			11.845
11:00 p.m.	London (RN)	GVU	11.770
		GVZ	9.640
		GRH	9.825
		GSU	7.260
		GSL	6.110
	(Via Leopoldville)	RNB	9.745
11:00 p.m.	London	GRS	7.070
		GRJ	7.320
		GRY	9.600
		GVW	11.700
		GSW	7.230
		GSB	9.510
		GSD	11.750
		GSF	15.140
11:00 p.m.	Melbourne (Shepparton)	VLC4	15.315
		VLA6	15.200
		VLG3	11.710
11:00 p.m.	Honolulu	KRHO	17.800
11:30 p.m.	Jerusalem	JCKW	7.220
11:30 p.m.	London	GVU	11.770
		GVZ	9.640
		GRH	9.825
		GSU	7.260
		GSL	6.110
	(Via Leopoldville)	RNB	9.745
11:30 p.m.	Colombo Ceylon	ZOJ	15.275
11:45 p.m.	Winnipeg	CKRO	6.150

AFTER MIDNIGHT

12:00 mid.	Durban, So.Afr.		6.170
12:00 mid.	Vancouver	CBRX	6.160
		CKFX	6.080
12:15 a.m.	Melbourne	VLC4	15.315
		VLG4	11.840
12:30 a.m.	Delhi	VUD5	15.190
12:30 a.m.	Lourenco Marques, Mozambique	CR7BD	15.380
1:00 a.m.	Edmonton, Alta.	VE9AI	6.005
1:00 a.m.	Vancouver	CKFX	6.080
1:00 a.m. (Sat.-Sun.)	Suva, Fijis (Relays BBC)	VPD2	6.135
1:00 a.m.	Capetown, S.Afr. (Relays BBC)	ZRK	5.885
1:00 a.m.	Melbourne (Relays BBC)	VLR3	11.880
1:00 a.m.	London	GSD	11.750
		GSB	9.510
		GSW	7.230
		GVW	11.700
		GSF	15.140
		GWR	15.300
		GRF	12.090
		GSO	15.180
		GRS	7.070
		GRY	9.600
		GSP	15.310
		GVX	11.930
1:00 a.m.	Melbourne	VLG3	11.710
1:30 a.m.	Delhi	VUD8	15.350
		VUD10	17.830
1:30 a.m.	London (RN)	GRM	7.120
		GRX	9.690
		GRV	12.040
		GSI	15.260
		GVZ	9.640
		GSN	11.820
2:00 a.m.	Vancouver	CKFX	6.080
2:00 a.m.	London	GSP	15.310
		GVX	11.930
		GSF	15.140
		GWR	15.300
	GRY 9.600	GRF	12.090
	GSD 11.750	GSO	15.180
	GSW 7.230	GRS	7.070
	GVQ 17.730	GSB	9.510
2:30 a.m.	Cairo	JCPA	7.190
2:30 a.m.	Leopoldville	RNB	15.170
3:00 a.m. (Sat.-Sun.)	Suva, Fijis	VPD2	6.135
3:00 a.m.	London	GSF	15.140
		GWC	15.070
		GWR	15.300
		GRF	12.090
		GRS	7.070
		GVQ	17.730
3:00 a.m.	Tokyo (Relays AFRS)	JLP	9.605
3:00 a.m.	Brisbane	VLQ2	7.215
3:30 a.m. (Sun. only)	Suva, Fijis (Relays BBC)	VPD2	6.135
3:55 a.m.	Rangoon, Burma		6.040
4:00 a.m. (Sun. only)	Wellington, N.Z.	ZLT7	6.715
4:00 a.m.	Delhi	VUD8	15.350
		VUD5	15.190
		VUD3	15.290
4:00 a.m.	Honolulu	KRHO	6.120
4:00 a.m.	Tokyo (Relays AFRS)	JLP	9.605
4:00 a.m.	Melbourne	VLR	9.580
4:00 a.m.	Melbourne (Shepparton)	VLC6	9.615
4:00 a.m.	Manila	WVLC	9.295
4:00 a.m.	Suva, Fijis (Relays BBC)	VPD2	6.135
4:15 a.m.	Delhi	VUD7/10	15.160
4:30 a.m. (Weekdays)	Wellington, N.Z.	ZLT7	6.715
5:00 a.m.	Honolulu	KRHO	6.120
5:00 a.m.	Tokyo (Relays AFRS)	JLP	9.605
5:00 a.m.	London	GRF	12.090
5:00 a.m.	Colombo, Ceylon (At dictation speed)	ZOJ	11.810
5:00 a.m.	Chungking	XGOY	11.920
5:30 a.m.	Colombo, Ceylon	ZOJ	11.810
5:30 a.m.	Delhi	VUD5	11.790
5:30 a.m.	Shanghai (Relays Tass)	XGOO	11.690
5:30 a.m.	Cairo	JCPA	7.190
5:45 a.m.	Leopoldville	RNB	17.770
5:45 a.m.	Singapore		9.555
			11.858
			7.220
6:00 a.m.	Tokyo (Relays AFRS)	JLP	9.605
6:00 a.m.	Jerusalem	JCKW	7.220
6:00 a.m.	Sydney, N.S.	CKCX	6.010
6:00 a.m.	Honolulu	KRHO	6.120
6:00 a.m.	London	GWC	15.070
		GSV	17.810
		GSJ	21.530
		GWR	15.300
		GSO	15.180
		GRF	12.090
		GSD	11.750
		GVO	18.080
		GVQ	17.730
		GVX	11.930
6:00 a.m.	Kalgan, China	XGCA	9.625
6:00 a.m.	Perth	VLW7	9.520
6:00 a.m.	Brisbane	VLQ2	7.215
6:00 a.m.	Georgetown, British Guiana (Relays BBC)	ZFY	6.000
6:30 a.m.	Delhi	VUD5	11.790
		VUD7/10	15.160
6:30 a.m. (irreg.)	Chungking	XGOY	9.810
			7.152
6:40 a.m.	Tashkent, USSR		6.825
6:40 a.m.	Moscow		6.800
			9.560
			11.630
			11.830
			15,750

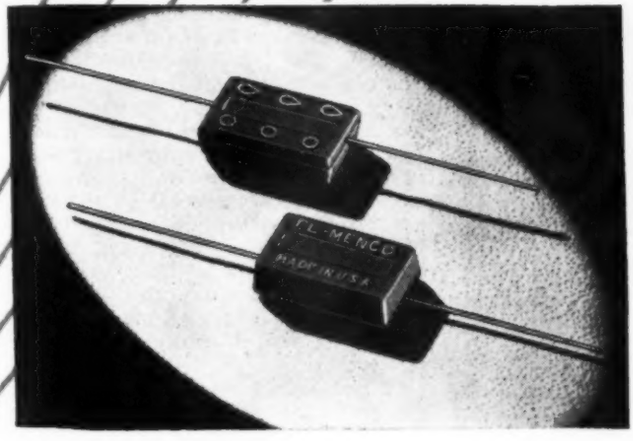
RN—Radio Newsreel.
(*Frequencies shown are in megacycles. To convert to meters divide 300 by the frequency in megacycles or 300,000 by the frequency in kilocycles.)

—30—

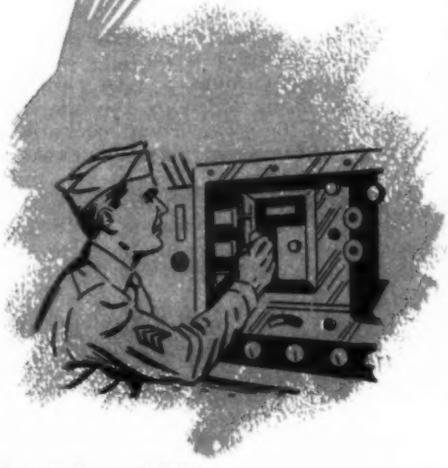


TOWARD NEW HORIZONS

Tested and proved in every important theatre of war, El Menco Capacitors will soon be serving with equal merit in the products of peace. Insure the correctness of this important part of your post-war product by specifying El Menco Capacitors.



Write on your firm letterhead for catalog.



El-Menco

CAPACITORS

Molded Mica — Mica Trimmer

ARMY E NAVY

THE ELECTRO MOTIVE MFG. CO.
WILLIMANTIC, CONNECTICUT

IMMEDIATE DELIVERY ON ALL ATR QUALITY PRODUCTS

AUTO RADIO Replacement VIBRATORS

Designed for Use in Standard Vibrator - Operated Auto Radio Receivers. Built with Precision Construction for Longer Lasting Life at *PRE-WAR PRICES!*

HEAVY DUTY VIBRATOR PACKS

For Inverting Low Voltage D.C. to High Voltage D.C. for Operation of Portable Receivers and Transmitters, Aircraft Apparatus, Public Address Systems, Amplifiers, and Scientific Apparatus.

STANDARD AND HEAVY DUTY INVERTERS

Specially Designed for Operating A.C. Radios, Television Sets, Amplifiers, Address Systems, and Radio Test Equipment from D.C. Voltages in Vehicles, Ships, Trains, Planes, and in D.C. Districts.

WRITE for LATEST ATR CATALOG — Just off the press!

AMERICAN TELEVISION & RADIO CO.
Quality Products Since 1931
ST. PAUL 1, MINN. U.S.A.

····· LETTERS ·····
FROM OUR READERS

SALUDOS AMIGOS

"JOSE A. TARTALETTI, LU7FF, Argentine radio amateur, cordially greets the publisher of RADIO NEWS and through him, all the American radio amateurs, and takes this opportunity to express his heartfelt joy for the peace that was made possible by the efforts of the United Nations that were consecrated to the democratic principles of Liberty and Justice, and hopes that soon W and LU will be broadcasting and enjoying the mutual privileges afforded by good neighbors."

Maciel, (Santa Fe)
Rep. Argentina

Ditto, OM

* * *

THANK YOU!

"ENCLOSED please find my first subscription to your wonderful RADIO NEWS magazine, of which I've recently become acquainted. Am sorry I did not learn of your magazine sooner. During my spare moments while in the Pacific, I completed two USAFI radio courses of instructions. In one of my letters to my Mrs. I asked her to send me a radio magazine. Of course, there are several on the market, so just took a chance, and hoping against hope, the Mrs. would send me a fair one at least, and what do you think she sent me—the best radio magazine on the market. Yes sir, gentlemen, I really enjoyed every article.

"I am especially interested in radio servicing and have been in the electric field for eighteen years and expect to open a radio and electric repair shop, of course, on a small scale.

"I am very much interested in the 'Practical Radio Course' by Alfred A. Ghirardi. . . . 'Let's Talk Shop' by Joe Marty was worth the price of the magazine. Let's have more of that good old shop talk. 'Service Procedure,' by Eugene A. Conklin was outstanding. Really enjoyed 'The Rural Radioman' by S. R. Winters. A masterpiece indeed and a godsend to the people of the 'Great Smokies'.

"Gentlemen, I could go on for hours praising your wonderful magazine. Worth far more than the price of 35c. Full of valuable articles for the average serviceman, of which I hope someday to be one of the many. Thanks a million. Keep up the good work."

Lt. (j.g.) R. F. Sheehan, U.S.N.
Somewhere in the Pacific.

Thanks for the bouquet, Lt.

* * *

RADAR HINT

"IN reference to the article on 'Practical Radar' in the September, 1945, edition, I would like to add the following statement to Mr. Jordan McQuay who designed it. He mentioned something about using his antennas as one combined unit but without any satisfactory results. My idea to his seekings is this; use a synchronized alternating current phase shift on the dipole antenna and just use the one for both purposes.

"The maximum values of each peak current value of a.c. change would in stroboscope fashion enable the radar to transmit and receive signals by a shift in phase of current applied."

Henry Alex Czarkowski
Philadelphia, Pa.

* * *

SUGGESTION

"NOW that the manufacturers are again building radios, I wish every serviceman would write the manufacturers and let them know the servicemen appreciate radios built so they can service them. Most of all, to have identifying markings on small postage stamp condensers and resistors with figures instead of all the colors of the rainbow. Build the radios so that when the chassis is pulled, the frequency scale comes along too. Help the serviceman out so when he lays the chassis on the table to service it, you don't have a pile of blocks to set it level.

"I wish all the manufacturers would insert in every radio a small test link in series with the B+ potential after the filter condensers so the serviceman can open this link and check all B+ leads to ground. Such an indication will give the serviceman a well earned break in determining if some condenser has gone shorted.

"Let's make all the wiring in the chassis color coded as red for highest voltages and any other color down to black for ground.

"Here's hoping the manufacturer gives the serviceman a break."

O. W. Brady,
South Bend, Indiana

Here's hoping!

* * *

"I'M a bit late but I wish to say that I would hate to see a free country compel a man to have a license for a job of work.

"Who can deny that radio servicing does not require work?

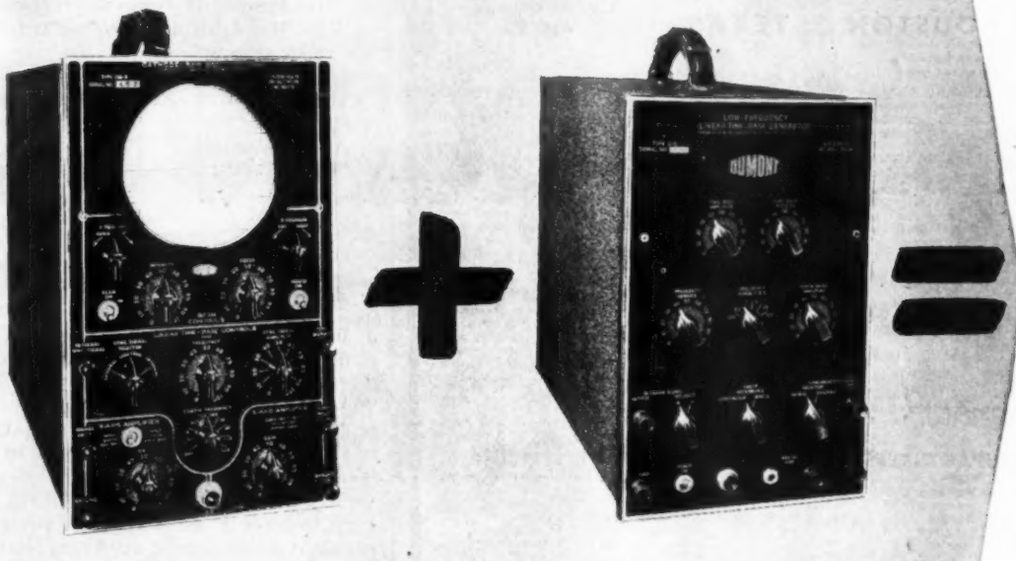
"For eight years I have earned a healthy living aided by the ingenious ability of the screwdriver mechanic to install filter condensers backwards, tighten trimmer condensers, make wrong connections, install wrong parts, drop solder between socket pins, and numerous other methods to keep my cash register from rusting. "Bless him!!"

Cpl. Floyd Perkins
Dudkhundi, India

* * *

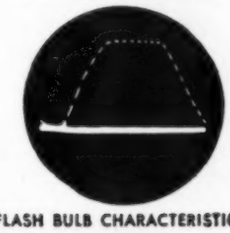
"HERE are my ideas for postwar receivers. These are based on my experience with the various types

Does your oscillograph have single or recurrent sweep frequencies as low as 0.2 cycles per second? *IT CAN . . .*



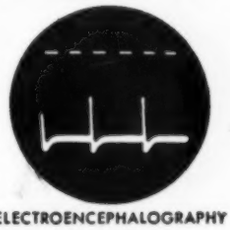
with the DuMONT Type 215 LOW-FREQUENCY LINEAR-TIME-BASE GENERATOR

ELECTROCARDIOGRAPHY



FLASH BULB CHARACTERISTICS

MACHINERY VIBRATION STUDY



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RELAY REBOUNCE STUDY

DIESEL ENGINE CYLINDER PRESSURE

Here's the means for *vastly increasing* the usefulness of your already useful oscillograph.

This accessory instrument provides a 450 v. d.c. or peak-to-peak *undistorted* linear-time-base signal voltage of a frequency variable from 0.2 to 125 cycles per second! Special compensating circuit assures linearity.

The single sweep can be initiated either manually or by observed signal. The oscillograph-screen pattern can usually be spread out to three times' full scale deflection. Return trace blanking signal of either positive or negative phase.

• • •

For single sweep, and for low-frequency recurrent-sweep studies, the DuMont Type 215 Low-Frequency Linear-Time-Base Generator used in combination with the DuMont Type 208-B general purpose oscillograph, or equivalent, provides excellent results. Note the typical studies herewith. Definitely "must" equipment.

Descriptive literature on request.

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"Across the Operating Table"
was the name of our Amateur Bulletin, as many of you will recall. There will soon be a new "Across the Operating Table" and you can sit across the table from us for our informal little "ragchews" by dropping us your name and address—a postal will do.

Equipment with Our Name on it Is Worth More to You
but costs just the same as anywhere else. For example, if you buy a communications receiver from us, you not only get the same receiver you would get anywhere else but you also have the benefit of our service, which includes:
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We have large stocks and an efficient Shipping Department which usually ships orders the same day they are received. We have a tube allocation plan which insures our customers getting their fair share of all tubes received by us. We have an efficient back order system for use on merchandise where the demand still exceeds the supply.

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serves industrial customers over a wide area. A qualified technical personnel is available on your problems.

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Bliley	Electronics Lab.	Jensen	Millen	RCA	Trimm
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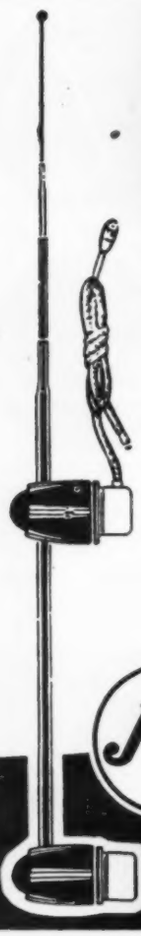

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Leaders in the auto antenna field for over a decade, JFD offers for prompt shipment auto antennas with these advantages:

1. **Seamless Admiralty Brass Tubing**
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of radio sets coming to me for repair.

"(1) R.f. stage in all sets with loop aerials. The table models and portables have lots of trouble at night with distant stations coming in on local broadcasts.

"(2) Smaller and lighter portables. Wavemagnets are good receivers, but not very portable.

"(3) Improved coils in sets, especially on S.W.

"(4) Larger speakers. The slight extra room they take is well repaid by the resultant tone difference.

"(5) Make all sets with steel chassis right side up.

"(6) Service diagrams on chassis or cabinet would make sets much easier to fix when regular diagrams are not given or available.

"(7) Fewer different tubes and models."

Wesley Rhodes
East Aurora, N. Y.

* * *

"IN going over my copy of RADIO NEWS I noticed a letter from J. W. Willoughby of Gainesville, Texas and I must say that I for one heartily disagree with him in a big way. They say that a person with a guilty conscience always hollers the loudest, but mine is very clear and I intend to holler plenty loud.

"My reasoning is that it isn't necessary to have a man with a diploma to repair a radio for as an Army instructor for radio repairmen I have seen a good many so-called men with diplomas that still didn't know what it was all about. I know that all radiomen can't graduate from the good old school of hard knocks, but in my estimation the repairman that has had to really dig for what he has had or will have in the future is the one that will be on the top when the others are leaving the radio-electronics field for a different job.

"To my estimation there is no school that is qualified to say that a man is a radio repairman or not, for the man may get good grades and know his work frontwards and backwards, but as to the proper contact with the actual customer he may know nothing. My assumption is that after he graduates from this school of radio repair he then will have to go to another school and learn how to contact people and how to associate with his fellow man, for I have seen a good many men that have come from the radio schools that didn't know anything of the proper approach to a customer in his everyday service business.

"Besides myself, I have seen a good many men and good radiomen that have learned their work the hard way from working for someone else and in my dealings with them I found that they knew just as much, and maybe a little more, about the service business as a great many of the school graduates that I have seen.

"It all boils down to the old argument of the licensing of radio repair shops which I could never condone,

THE NEW

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START ROLLING SOON!

A WHOLE *new* line of Stromberg-Carlsons—and just wait till you see and hear them! *New* in their engineering. *New* in their cabinet designs. *New* in their price range. *New* in their broader scope of models. They'll give new meaning to the old saying, "There is nothing finer than a Stromberg-Carlson!"

All new Stromberg-Carlsons take advantage of every latest engineering advance in the science of electronics. FM sets have both present and newly approved tuning ranges for clear and satisfactory reception of international short wave, precision tuning is made easy with spread-band dials. Floor models employ speaker systems with either full-floating suspension or Carpinchoe speaker and the famous acoustical labyrinth. Phonograph models use newly designed record-changers that perform to entirely new standards of speed and simplicity of operation. All new Stromberg-Carlsons have built-in antenna systems for all tuning ranges on their dials. Special plug-in provision is made in many models for the incorporation of Stromberg-Carlson wire-recording and reproduction.

Almost everyone has wanted – even if he couldn't afford – Stromberg-Carlson quality, Stromberg-Carlson perfection of reproduction. The new line lets authorized dealers meet practically any customer's demand with a model expressly suited to his own individual taste and needs. Yes, today, Stromberg-Carlson is the ideal radio for the *main* radio in any home!

Make Stromberg-Carlson the *main* radio in your showroom; cash in on the heavily advertised Stromberg-Carlson *main* radio theme. You'll find it the radio of real profit-opportunity.

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THE BEAUX ARTS — 1110 PTW . . . New, amazingly compact, automatic table radio-phonograph in smart modern design.

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A Complete, Practical Handbook of Present-day TELEVISION

Now, the tremendous opportunities in the field of television are brought within your reach—by means of this crystal-clear book. Written in plain English, concise and up to the minute, it makes television *easy* to understand. There is no mathematics to confuse you and make explanations difficult to follow. Hundreds of vivid illustrations bring every fact and point right before your eyes. You'll be amazed at how simple television can become with

TELEVISION SIMPLIFIED

by MILTON S. KIVER

Associate Instructor in radio, U.S. Army Air Forces. Formerly Instructor in radio, Illinois Institute of Technology.

This brand-new, authoritative handbook not only contains all the information you need for success in television, but covers the trouble shooting and repair of radio sets. Beginning with a clear, overall picture of the entire field, it breaks down the television receiver into its component parts and circuits. It analyzes them, step by step, showing how they are formed, the roles they play, and their operating characteristics.

BRIEF OUTLINE OF CONTENTS

The Television Field; Ultra-high Frequency Waves and the Television Antenna; Wide-band Tuning Circuits, Radio-frequency Amplifiers; The High-frequency Oscillator, Mixer and Intermediate-frequency Amplifiers; Diode Detectors and Automatic Volume-control Circuits; Video Amplifiers; Direct-current Reinsertion; Cathode-ray Tubes; Synchronizing Circuit Fundamentals; Deflecting Systems; Typical Television Receiver—Analysis and Alignment; Color Television; Frequency Modulation; Servicing Television Receivers; Glossary of Television Terms.

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Please send me "Television Simplified." Within 10 days I will either return the book or send you $4.75, plus a few cents postage. (*If you enclose check or money order for $4.75 with this coupon we will pay the postage. Same return privilege, and refund is guaranteed.*)

Name.....

Address.....

City.....State.....

Radio News—Dec. 45

for we have the old situation of the gullibility of the American people. When I was younger I had to learn things the hard way for I knew that my parents were always wrong and that is the reaction of the American people. Mrs. Jones just knows that little Johnny next door knows more about radio than the serviceman on the corner, for after all hasn't he been peddling papers to her house for five years and can't she tell an honest boy when she sees one.

"My letter isn't to say that Mr. Willoughby is wrong for after all he has the right to say what he thinks, but so have I, for I am in uniform doing my bit to keep my country a democracy and a home where I may have the freedom of viewing my opinions.

"I also would like to know what the other servicemen have to say."

Pfc. Jay P. Gladieux
Alaska

Looks like "organizing" leads in the voting so far—not licensing.

* * *

AN OLDTIMER

"REPLYING to Mr. John Roger's letter in your October issue: Huh? (Roger!)

"It might be of interest to you (it is to me!) to know that I have been reading RADIO NEWS since 1920!"

Horace D. Westbrooks
Griffin, Georgia

You missed 1919, Horace!

—30—

Wave Guides

(*Continued from page* 37)

reactance (Fig. 1B). A combination of the two can be designed to act as a parallel resonant circuit with an infinite shunt impedance (Fig. 1C).

A small section of wave guide about a quarter of a wave-length long and connected to the side of the main guide behaves as a shunt resonant circuit with a high shunt impedance (Fig. 2). If the stub is a half wavelength long, it presents a short circuit across the main wave guide (Fig. 4). Various other implements and devices are used to make measurements and to perform the duties of ordinary low-frequency circuit components.

Early work on wave guides was hampered considerably by the non-existence of tubes that would generate more than very small amounts of power at wavelengths short enough for use with wave guides of a practical size. Early tubes used for this purpose were usually of the positive-grid, negative-plate type known as Barkhausen oscillators (Fig 3). Other types used were velocity modulation oscillators with resonant metal cavities mounted on the tube, and magnetrons which operate in the field of a powerful magnet.

The I.R.E. Proceedings for March, 1944 published a reprint of an article which appeared in volume 10, 1940, of Journal of Technical Physics (Russian), indicating that Russian scientists have developed magnetrons capable of furnishing as much as 300 watts at a wavelength of 9 cm. and 2 watts at 2.6 cm. wavelength. These latter waves could be transmitted through a wave guide of little more than half an inch in diameter. *(Much higher power is used in American radar equipment. Ed.)*

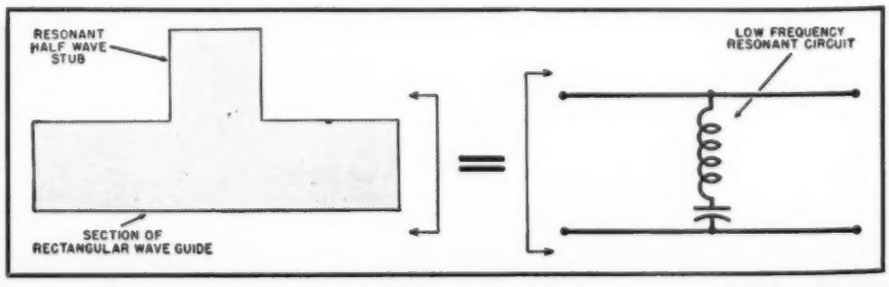
How does all this affect the future of television? In order to answer this question, let us discuss television requirements briefly.

One objective sought in a television broadcast is to make available a picture that is as distinct and clear as possible; that is, the detail must be sharp. You all have had the undesirable experience of taking a snap-shot and of having the picture appear fuzzy and slightly out-of-focus. In order to produce a sharp television picture, the picture is broken up into thousands of small parts, over 350,000 parts in some cases, and each tiny segment is transmitted individually. This 350,000 segment picture is repeated 30 times each second. In order to perform this stupendous task it is necessary to transmit television pictures at very high frequencies.

The Federal Communications Commission allots a radio frequency band six million cycles wide to each television station as compared with the ten thousand cycle band allotted each radio broadcast station. A single television station occupies a band of frequencies six times greater than the combined frequency bands of all the radio broadcast stations in the U.S.

Future prospects of color television indicate the necessity of a band six million cycles wide for each color transmitted. Hence it was necessary to allot the television stations a portion of the frequency spectrum far removed from the normal broadcast band. This is the 50 to 300 million cy-

Fig. 4. A half-wavelength of wave guide connected to a section of wave-guide transmission line presents a shunt short-circuit at the frequency of resonance.



A background of *Performance*—over 50 years—is the *inside story* of the popularity that has brought leadership to *Thordarson* transformers. Performance over the years, after all, is the only true test of product quality.

Consumer acceptance will continue because *Thordarson* research and design engineers are never satisfied just keeping abreast of the times. These men are continually developing many transformer components which are instrumental in the production of new and better performing devices and equipment for the electronics industry.

This same pioneering spirit has been responsible for many new *Thordarson* transformer applications and developments during the war . . . all of which will be available shortly for civilian requirements.

Thordarson's well-tested methods of sales promotion and distribution will continue their joint task of making *Thordarson* Transformers, together with complete information on their applications and use, available to everyone in the field.

Always think of Thordarson for top-notch transformers!

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MAGUIRE INDUSTRIES, INCORPORATED

We are Delivering RECEIVERS

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The hams who ordered early are *now* getting their communications receivers — just as fast as we can ship them out. Our stocks of popular sets are getting better all the time — prices are right (you may buy on easy, time payments if you wish) — shipments are prompt. Order one of these nationally known sets from the Radio Shack *today*.

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NATIONAL

The famous HRO with 6 sets of general coverage coils, tubes, power supply, and spkr $314.00
NC-240-C ..... about $225.00

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Regularly sold for $3.96
Your cost—only 79c
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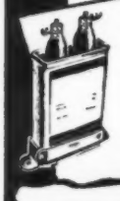

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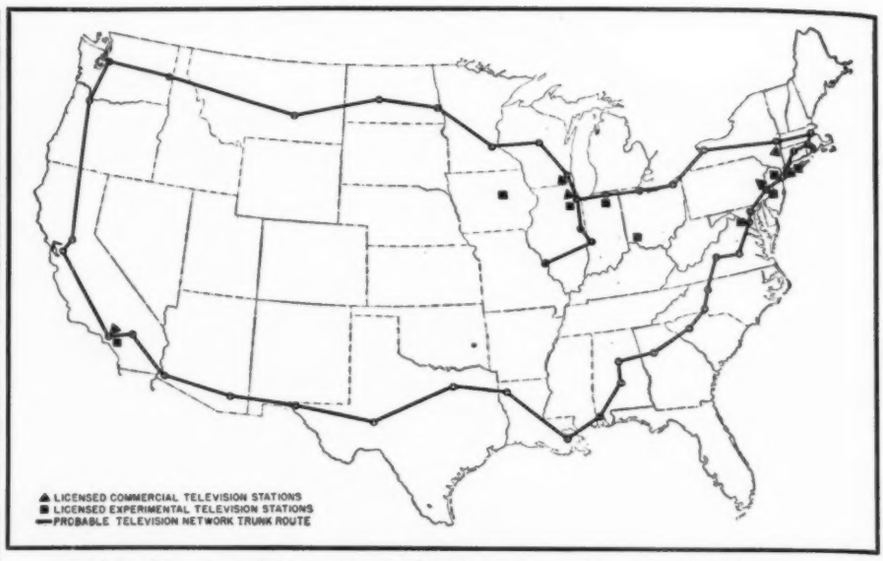
▲ LICENSED COMMERCIAL TELEVISION STATIONS
■ LICENSED EXPERIMENTAL TELEVISION STATIONS
— PROBABLE TELEVISION NETWORK TRUNK ROUTE

Nation-wide map of the various television stations (commercial and experimental) and the possible path of cross-country television network trunk routes.

cle region heretofore used only for experimental purposes.

A peculiar change takes place in radio waves at these high frequencies however, and, unlike the familiar broadcast radio, ultra-high frequency radio waves will not carry signals much farther than the horizon. These waves are similar to light waves in that respect. This means that a television transmitter located even as high as the Empire State Bldg. can be received no farther than 50 to 60 miles distant and furthermore it is unusual to have a 1000 foot tower so conveniently available. Thus, television "listeners" located a relatively short distance away may not be able to receive the broadcasts.

Complete coverage of an area is, therefore, possible only by means of a network of stations. One deterring factor that has held up the establishment of networks is the lack of available facilities for transmitting the television pictures between stations. Existing telephone lines cannot be used because they are not capable of transmitting the high frequencies necessary for good television pictures. A special kind of transmission line will have to be installed linking the stations of such a network.

Wave guides offer a solution to this problem. A frequency band sufficiently wide to transmit one or several television pictures with the associated sound channels and control circuits could easily be handled over a single wave guide.

Another peculiarity of the high-frequency waves used in television broadcasting is that they will not pass through large structures such as skyscrapers, large apartment houses, elevated railroads, and the like. Such structures will cast a rather well-defined shadow in which the reception will be either poor or non-existent. Poor reception may be evidenced by such phenomena as fading of the picture or multiple appearances of the picture lurking in the background. These latter are known as *ghosts*. Troubles of this sort are mainly experienced in densely populated areas and could be overcome by supplying these receivers from a central distributing point through a special type of transmission line such as a wave guide.

One other limiting factor to television, as it is at present, has to do with picking up programs at locations other than at the main studio. Special feeder lines must be used for transmitting these pictures between the scene of the entertainment and transmitting station or stations. Most of the present-day programs originate in studios connected to the transmitter by single channel coaxial cable transmission lines. Portable radio systems are sometimes used in place of the transmission line in special cases but these may not be practical to use in the quick shifting news broadcasts and around-the-town scenes which will make up the programs of the future.

The desirable conditions of course would be those where the television program could be picked up at any location. You will want to be able to see Rita Hayworth when she arrives at the Grand Central Station, the *Bums* making a winning home-run, and our future Presidents making their inaugural speeches. Not only you, but everyone else in the United States, would like to be able to have a ringside seat at these events.

Television is straining at the leash, ready now to surge into the American way of living and as Niles Trammell, President of the NBC, stated recently in the New York Times, "Television promises to be the greatest medium of mass communication yet evolved, with unparalleled opportunities for entertainment and education."

The use of wave guides may be the answer to obtaining for us, at an earlier date, the full realization of the benefits of television for all the peoples of these United States.

—30—

Five inch 'scope for pulse work complete with tubes and conversion instructions into a standard 'scope as shown at left.

Catalog No.....6RE-1
Your Cost.....**$50.00**

"SCOPE SCOOP"

Here it is converted to a standard 'scope with 2 cycles to 25 KC horizontal sweep circuit.
Catalog No.....6RE-2
Your Cost.....**$90.00**

BASIC MODEL 6 RE-1 INCLUDES:

- 5" 5BP4 Cathode Ray Tube
- Vertical and horizontal positioning controls
- Intensity control
- Focusing control
- Sweep control
- Horizontal amplitude control
- 2500 volt and 400 volt power supplies 115 V 60 cycles
- 2 x 2 and 5T4 rectifiers
- One 6AC7 pulse amplifier
- Two 6SJ7 amplifiers
- Six 6L6 amplifiers

CONVERTED MODEL 6RE-2 INCLUDES:

- Horizontal and vertical amplifier gain and positioning controls
- Focusing controls
- Intensity control
- Internal linear sweep oscillator —2 to 25,000 cycles in 7 ranges
- Front panel input connections
- Four 6L6 amplifiers
- One 6AC7 vertical amplifier
- One 5T4 One 2 x 2 rectifiers
- One 6SJ7 Sweep amplifier
- One 884 oscillator

- **For all types of High Frequency Pulse Work in Television, Radar and other Pulse Applications.**
- **Complete with Tubes for this Work.**
- **Easily Converted to Conventional 5-inch Scope.**

Five inch 'scopes from Signal Corps Radar Sets—built like a battleship by Western Electric to stand up under the most severe field conditions and rigid requirements of the Signal Corps. Every part is conservatively rated, assuring long periods of trouble-free service. Ideal for all types of high frequency pulse work in television, radar and other pulse applications, the unit is supplied complete with tubes ready for this type of work.

Any service man or amateur can easily convert this unit into a conventional five inch 'scope. Complete instructions are furnished with each unit. Ten dollars worth of easy-to-get parts and a few hours time with ordinary hand tools will do the job. Yes, we supply them converted, too, as shown in the photograph on the right!

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BUFFALO RADIO SUPPLY

219-221 Genesee Street

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BUFFALO 3, N. Y.

All kinds of radio tubes in stock at best wholesale prices. MAIL IN YOUR ORDERS FOR ALL TYPES NEEDED, NOT JUST THE CRITICAL NUMBERS, AND WE'LL TRY TO FILL THEM COMPLETELY ! ! !

Tubular Condensers (All guaranteed one year)

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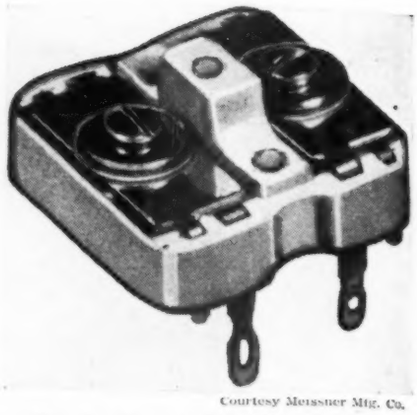
(*Continued from page* 62)

are employed instead of the less expensive mica compression type. However, the arrangement of Fig. 5, which employs conventional mica-compression type trimmers for capacitor-substitution tuning of the antenna circuit only, is widely employed because the usual antenna circuit tunes somewhat broadly and so is not so critical to the amount of capacitance variation that might be caused by temperature or humidity changes, ageing, etc. (The subject of inductance and capacitance stability with temperature and humidity changes will be considered in greater detail in several later articles of this series.) Iron-core inductor tuning is used for the oscillator circuit, where the tuning needs to be more precise. Many push-button receivers that employ a tuned r.f. stage ahead of the converter tube use capacitor substitution tuning for the antenna stage and iron-core inductor substitution tuning for both the oscillator stage and the converter tube input.

Reference to Fig. 2 will reveal why push-button tuning by this method does not cause any special oscillator-preselector tracking problems. When the individual preselector and oscillator tuning capacitors associated with a push-button switch are initially adjusted in order to *set up* that button for reception of the particular station assigned to it, they really are being adjusted to tune the preselector and oscillator circuits to the correct frequencies for reception of that particular station. Therefore, the oscillator and preselector tuned circuits will be *tracked* correctly. Thus, suppose one of the push-buttons S_3 in such a receiver is to be *set up* for reception of a 1000 kc. station, and that the receiver employs an i.f. of 455 kc. To set up this button for reception of this particular station, preselector capacitor C_{p3} (see Fig. 2) would have to be adjusted to tune the preselector to exactly 1000 kc. and oscillator capacitor C_{o3} would have to be adjusted to tune the oscillator to exactly $1000 + 455 = 1455$ kc. This would be done in practice, by feeding a 1000 kc. signal into the receiver input by means of a signal generator, and then adjusting C_p and C_o for maximum receiver output (if the receiver employs a magic-eye tuning indicator this could serve to indicate when maximum output was being obtained). This would make the oscillator operate correctly at a frequency 455 kc. higher than that of the station signal and the preselector tuned circuit—for this particular station frequency. The other buttons on the receiver would be set up in a similar manner for whatever station frequencies they might be assigned to—hence the oscillator frequency would track correctly for each push button.

The conventional adjustable mica-compression type trimmer capacitor used in push-button receivers is able to cover only a limited capacitance variation range—depending upon its construction and its maximum capacitance value. For example, Table I lists the capacitance ranges of the trimmer-type capacitors of various sizes made by one prominent manufacturer of these units.



Courtesy Meissner Mfg. Co.

Fig. 9. A typical dual mica compressor-type capacitor unit used with each push-button in receivers of the type illustrated in Fig. 2.

Trimmer type capacitors should never have to be adjusted very loosely, or too tightly for reception of the station, for, in either position, they will not maintain the capacitance value constant for very long. Temperature, ageing effects and vibration affect it. Accordingly, it is common practice to use trimmers of two or three different maximum capacitance values in a push-button receiver that employs them, and, in order that the station frequency assigned to a button shall always be such that the frequency falls well within the minimum and the maximum adjustment range of the trimmers associated with it, certain buttons (those associated with the trimmers of *smaller* capacitance) are assigned for use at the high-frequency end of the broadcast band, others for use at the mid-frequencies, and others (those associated with the trimmers of *largest* capacitance) for use at the low-frequency end. Sufficient overlap of tuning range is provided between these groups of buttons so that no difficulty is experienced in assigning a certain group of stations to suitable buttons. For example, in the 5-button receivers of the *Philco* 42 series, the station-frequency ranges to which the various buttons *A*, *B*, *C*, *D*, and *E* are assigned are as indicated at the left

Table 1. Capacitance ranges of various trimmer type capacitors manufactured.

Capacitance Range	Capacitance Ratio (Max. to Min.)
1.6 μμf. to 18 μμf.	11.2
3 μμf. to 35 μμf.	11.7
4μμ f. to 70 μμf.	17.5
10 μμf. to 160 μμf.	16.0
20 μμf. to 270 μμf.	13.5
40 μμf. to 370 μμf.	9.3
70 μμf. to 470 μμf.	6.7
110 μμf. to 560 μμf.	5.1

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of Fig. 11. The preselector (*ant.*) and oscillator (*osc.*) trimmer adjustment screws for each of the five push-buttons are arranged as indicated. The signal-frequency ranges of the various buttons are illustrated by their frequency range graphs drawn at the right. Notice how the frequency ranges of adjacent buttons are purposely designed to overlap. For this reason, when station assignment adjustments (button *set-ups*) are to be made on a push-button receiver, the manufacturer's service instructions, or the frequency-range markings on the trimmer adjustment screws should always be consulted so the proper push-button will be assigned to each station that is to be received. Then the station will lie within the proper frequency limits of the circuits associated with that particular push-button.

The majority of push-button tuners that employ the straight trimmer-capacitor substitution system, use only two banks of trimmers, and so are usually employed in superhets that do not have a preliminary tuned r.f. stage. One bank of trimmers is used for tuning the mixer or converter tube input circuit, and the other for tuning the oscillator. In other words, for each push-button a dual trimmer-type substitution capacitor unit (see Fig. 9) is used in place of the conventional 2-gang variable tuning capacitor. If a tuned radio-frequency stage precedes the mixer or converter tube, there are three tuned circuits, and a 3-gang variable tuning capacitor would be employed in a manually tuned receiver. For automatic tuning a 3-gang trimmer unit is used. Each substitution trimmer capacitor used in the push-button tuned receiver may be thought of as corresponding to a section of the ganged variable tuning capacitor (with its rotor in a certain position) in the manually tuned receiver.

High Side and Low Side Switching

The substitution capacitors or inductors in a given bank are usually arranged so that one set of terminals is connected to a common bus wire, and the other side of each capacitor or inductor is connected to its respective switch (see Figs. 2 and 3). In some circuit systems, the push-button switches are in the high potential or grid side of the tuned circuit, with the common side of the substitution capacitors or inductors grounded. This is known as *high side* switching. In others, the common side of the capacitors or inductors is the high potential, or grid side, of circuit, and the low potential, or ground side, of each is connected to the switches (as in Figs. 2, 3, 4, 5, and 6). This is known as *low side* switching.

High side switching is the more commonly used in receivers that provide *both* manual and automatic tuning, because it permits of a simple switching system from manual to automatic tuning and back again by means of one push-button. This is desirable because it tends to reduce the cost and simplify the operation of the receiver, two factors which are important in receiver manufacture.

Iron-Core R.F., Oscillator, and I.F. Coils

The use of properly designed compressed iron-dust cores in r.f. preselector, oscillator, and i.f. tuning coils makes it possible to realize a decidedly higher Q in a very small coil (and shield can) than is obtainable by the use of an air-cored coil of comparable size. The higher Q makes possible higher gain and increased selectivity with the use of small coils, and, among other things, results in a decided saving in space. This is very important in compact receivers such as portables, automobile and aircraft receivers, etc., and in push-button tuned receivers that employ a series of coil sets in a coil-substitution system (see Figs. 3, 4, and 5). Another advantage of well-designed iron-core inductors lies in the fact that a high degree of adjustment stability can be obtained over a long period of time, regardless of temperature changes, jolting, and other severe service conditions.

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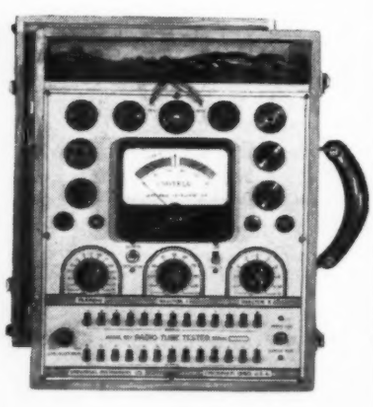

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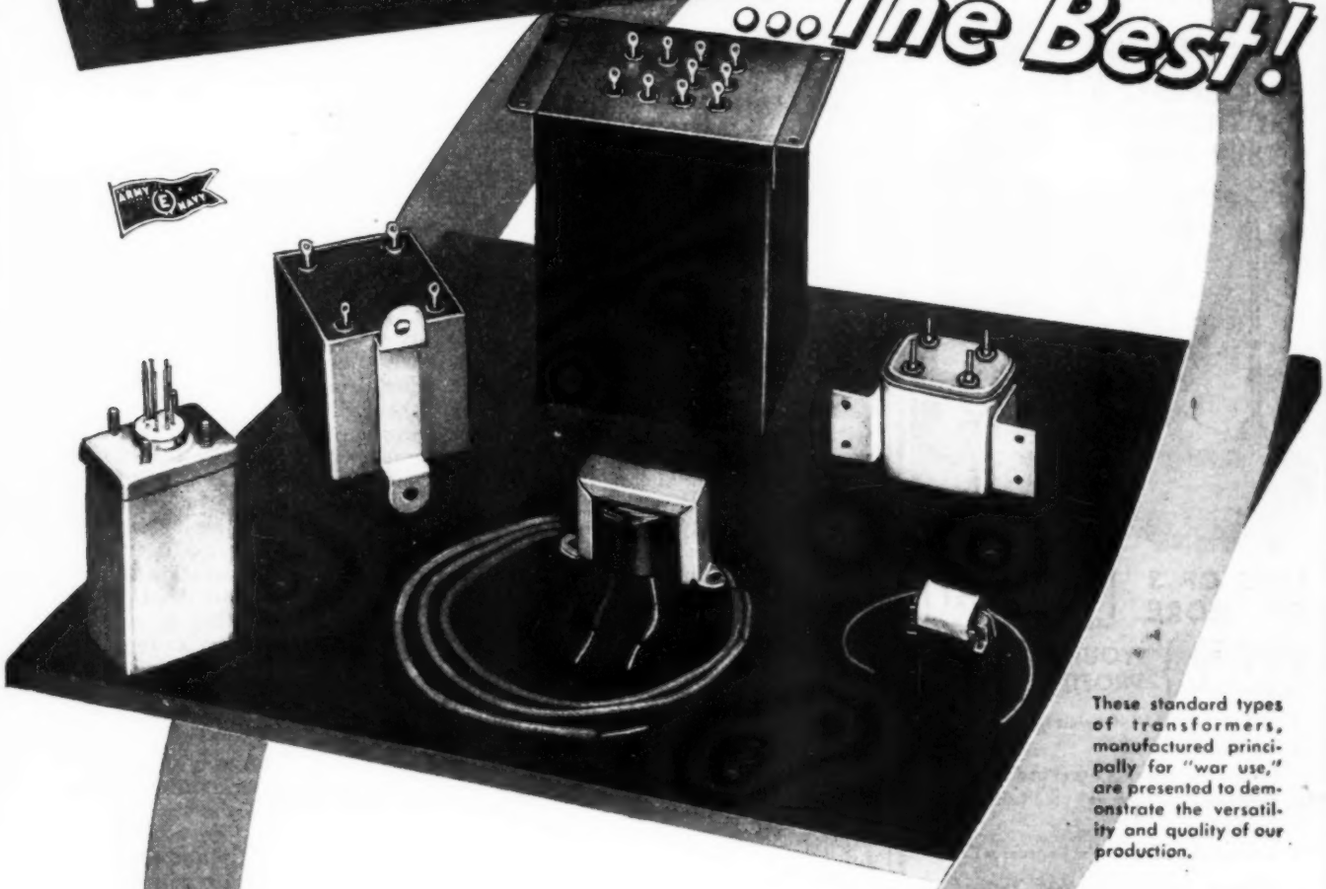

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which is dependent upon the frequency of the station to which the particular push-button has been assigned.

The simplest arrangement for each pair of adjustable iron-core coils used in receivers employing such coils in two-stage tuning (one preselector stage and oscillator, as in Figs. 3 and 4) is to have two separate cores each with a screw molded therein. The position of these cores is adjustable in coils mounted adjacent and parallel to each other, one the preselector and one the oscillator coil. The two cores may be connected together mechanically by a pressed yoke of non-magnetic metal to which is attached a position-adjusting screw that comes forward through the panel, near the proper dual push-button switch that simultaneously switches the two coils in or out of the circuit.

Setting the oscillator frequency the correct amount higher than the preselector frequency, for each push-button, does not present any special problem when such coil systems are employed. To set up a push-button for reception of any particular station, within its recommended frequency range, the push-button is depressed and the position of the cores in the two coils associated with it are adjusted separately by means of their adjusting screws until that station is received at maximum level. Then the inductance of the preselector coil will have been adjusted to the proper value to tune the preselector circuit to the signal frequency of that particular station, and the inductance of the oscillator coil will have been adjusted to the proper value to tune the oscillator circuit to a frequency *higher* than that of the station by an amount numerically equal to the i.f. of the receiver. Correct osc.-preselector tracking for that pair of coils will then have been established. From then on, that button may be set up for reception of some other station within its recommended range if required, by merely adjusting the single screw fastened to the yoke—thus moving both cores simultaneously. The tracking will remain sufficiently accurate for all ordinary purposes. Other mechanical arrangements can be, and are, used to bring about the same end.

In order to facilitate tracking the oscillator and preselector coils, the oscillator coil can be either wound differently in shape or size from the preselector coil, or its iron core can be made shorter. A more expensive way is to shape the iron core, or even to make the two cores of different permeabilities but similar physical dimensions, to arrive at the same result.

Dual Preselector-Oscillator Tuning Coil Units

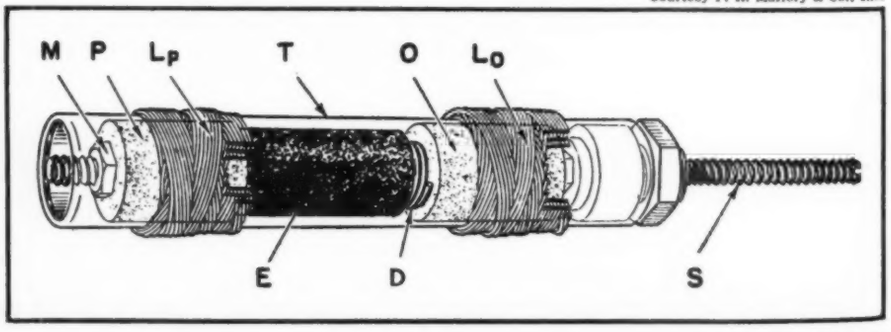
The dual type iron-core tuner coil unit is another construction arrangement employed when adjustable iron-core coils are employed in both stages of two-stage tuning (see Figs. 3 and 4). It makes possible an iron-core substitution type tuner unit requiring only *one* adjustment for setup of each push-button. Tracking between the oscillator and preselector coil inductances is fixed at the correct value by preliminary adjustment at the factory, and rarely requires readjustment in the field thereafter.

In one simple arrangement, both cores are mounted on a single shaft of wood, brass or other non-magnetic material, and this combination is slipped through the center of the tube carrying both the preselector and oscillator coils. The coils are *tracked* one with the other by sliding either one of the cores on the shaft, or by sliding either coil along the tube. Then the whole assembly can be adjusted for reception of any one station by adjusting the long screw provided for simultaneously moving the two cores in or out of the coil tube as required.

An example of a more elaborate dual-coil construction designed to make the adjustments more stable and permanent, and which requires adjustment of only a single screw for setting up a button, is illustrated in Fig. 10. In order to show clearly all parts of the coil and core assembly, it is shown both in phantom and in cutaway. Preselector coil L_p and oscillator coil L_o are wound on a fibre tube *T*. To facilitate tracking, the oscillator coil is placed nearest the front end of the tube, where the slotted station-adjustment stud *S* is provided.

Brass stud *S* carries the compressed powdered-iron cores *P* and *O* for both coils, causing both to move simultaneously when the push-button is being *set up* to receive a particular station. The cores are held a fixed distance apart by Bakelite spacing sleeve *E*, spring *D*, and spacing nut *M*. First, the preselector tuned circuit is tracked

Fig. 10. A dual adjustable iron-core inductor for tuning the preselector and oscillator.
Courtesy P. R. Mallory & Co., Inc.



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with that of the oscillator by varying the position of spacing nut *M*. This moves the core of the preselector coil L_p only, and hence varies the inductance of the preselector coil only. This tracking adjustment is made at the factory for each set of coils, so it need not be repeated unless the position of the nut has changed during receiver use. If the cores are moved too close together, another seemingly correct adjustment may be obtained at certain frequencies. However, if the adjustment stud *S* should later be moved to set up the button to a different station, the coils will be out of track. It is to guard against this possibility, that Bakelite spacing sleeve *E* is placed between the cores.

When dual coils are used in receivers which employ a Colpitts type oscillator circuit, some interaction in the adjustments of the buttons may be experienced. This is because the capacitance between the coil and its core is being placed across one section of the tuning capacitance. The effect of one adjustment on the others will be slight, but sometimes it is noticeable. In such cases, it is advisable to recheck the adjustment of each button after set-up is completed to make certain that the tuning has not changed.

When a stage of tuned r.f. amplification is employed in the push-button tuned receiver, one of several arrangements may be used for tuning it. Two of the most popular ones are those using a trimmer-capacitor tuned antenna circuit with iron-core coil tuned interstage and oscillator circuits, and those using triple iron-core coil tuning.

The circuit arrangement of an interesting push-button controlled tuner using triple iron-core tuning is shown in Fig. 7. The auto-radio receiver that employs it provides for either automatic or manual tuning. At this point we are interested only in the former. The push-buttons are located on a control panel on the instrument board of the car—remotely located from the receiver chassis. Each push-button operates an electromagnet which in turn operates the station selector switch that switches the proper iron-core inductors into the antenna, interstage, and oscillator circuit. Five station push-buttons are provided. Each set of three iron-core inductors may be pre-tuned by a single adjustment for reception of a particular station, thus simplifying the station setup procedure. A push-button operated relay is used to change over automatically from automatic to manual tuning.

Receivers Providing Both Automatic and Manual Tuning

In those automatic-tuned receivers of the types in which a conventional gang tuning capacitor is rotated by an electric motor, a solenoid and ratchet, or by mechanically-operated cam and lever systems, all that is necessary to also provide manual tuning is to employ a clutch arrangement by which the tuning capacitor shaft may be disengaged from whatever automatic driving mechanism is employed, and then providing a regular tuning knob and drive for manually rotating the gang tuning capacitor shaft. The same tuning coils are used for both manual tuning and automatic tuning.

In those automatic-tuned receivers of the types employing preset substitution capacitors or iron-core inductors, manual tuning may be accomplished by also incorporating in the receiver a conventional manually-operated gang tuning capacitor with its associated fixed preselector coil, oscillator coil, padder capacitor, waveband switch, etc. When manual tuning is desired, these are switched into the preselector and oscillator circuits in place of the push-button controlled trimmers and iron-core inductors. Fig. 12 illustrates the preselector and oscillator circuits of a receiver of this type. When the manual-automatic switch S_1 is in the position for push-button tuning (the position shown in the diagram), contacts *1-2* and *5-6* are open; *3-4* connect, and *7-8* connect, as illustrated. This cuts the manually-tuned preselector and oscillator tuning circuits L_1C_1 and L_2C_2 out of the circuit, and switches in their place the bank of pre-set push-button selected iron-core preselector and oscillator coils L_4. Coil L_3 serves to couple the oscillator plate (screen grid of the converter tube) and grid (inner grid of the tube) circuits together via the tickler coil L_5.

When the manual-automatic switch S_1 is pushed *up* for manual-tuning operation, contacts *3-4* and *7-8* open, thus cutting the bank of iron-core coils and push-button station selector switches out of the circuit. Simultaneously, contacts *1-2-3* close and contacts *5-6-7* close, thereby connecting preselector and oscillator coils L_1 and L_2, padder C_p, and corresponding ganged manually-tuned capacitors C_1 and C_2 into the circuit. Notice that the connec-

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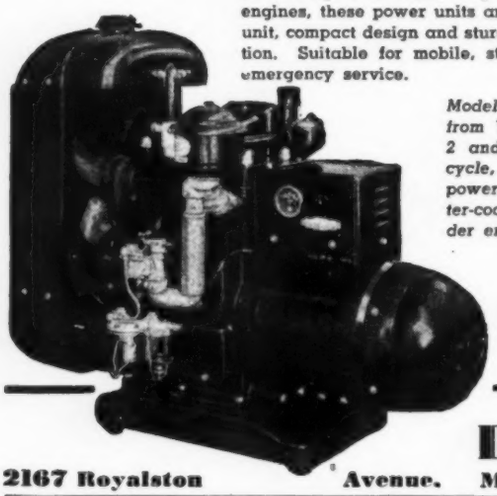

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Statement of the ownership, management, circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of Radio News, published monthly at Chicago, Ill., for Oct. 1, 1945. State of Illinois, County of Cook, ss. Before me, a notary public in and for the State and county aforesaid, personally appeared A. T. Pullen, who, having been duly sworn according to law, deposes and says that he is the business manager of Radio News and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Wm. B. Ziff, 185 N. Wabash Ave., Chicago 1, Ill.; Editor, Oliver Read, 185 N. Wabash Ave., Chicago 1, Ill.; Managing Editor, Oliver Read, 185 N. Wabash Ave., Chicago 1, Ill.; Business Manager, A. T. Pullen, 185 N. Wabash Ave., Chicago 1, Ill. 2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Ziff-Davis Publishing Co., 185 N. Wabash Ave., Chicago 1, Ill.; A. Ziff, 185 N. Wabash Ave., Chicago 1, Ill.; W. B. Ziff Co., 185 N. Wabash Ave., Chicago 1, Ill.; S. Davis, 185 N. Wabash Ave., Chicago 1, Ill.; Wm. B. Ziff, 185 N. Wabash Ave., Chicago 1, Ill.; B. G. Davis, 185 N. Wabash Ave., Chicago 1, Ill. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. 5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is..... (This information is required from daily publications only.) Arthur T. Pullen, Business Manager. (Signature of business manager.) Sworn to and subscribed before me this 28th day of September, 1945. [Seal.] A. C. Jeppe, Notary Public. (My commission expires March 16, 1949.)

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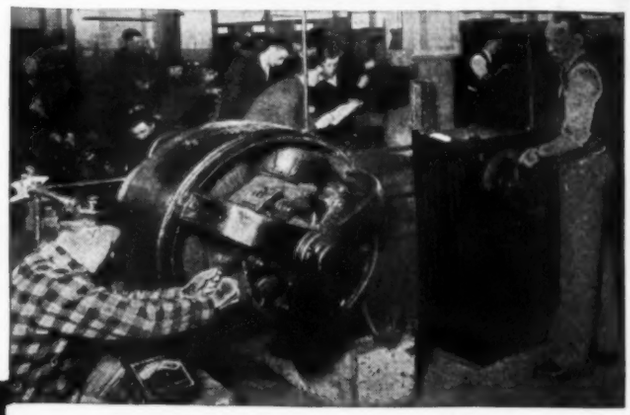

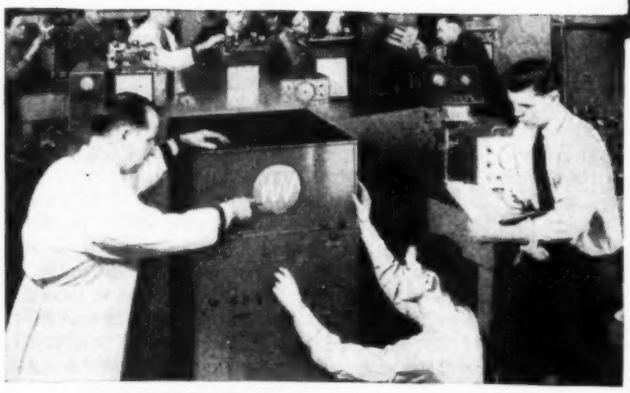

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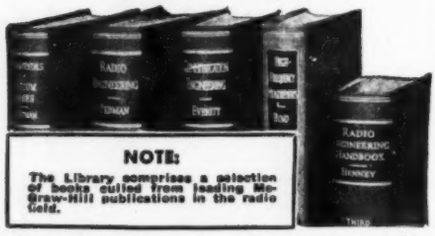

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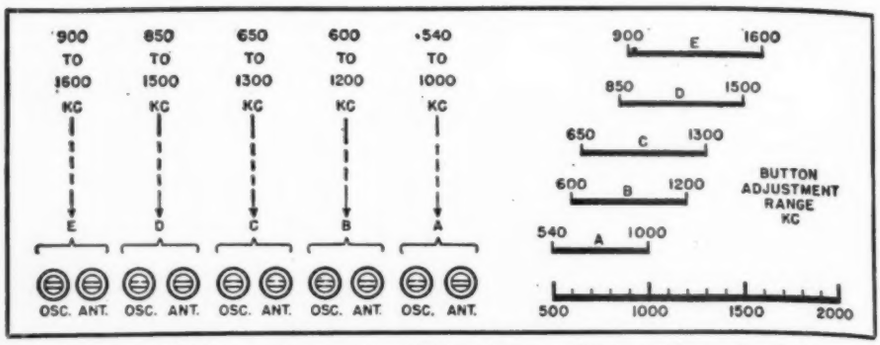


Fig. 11. (Left) The antenna and oscillator trimmer adjustment for each of the five push-buttons, A, B, C, D, and E (Philco model 42-1010 and 42-1011 receivers). Also shown is the station frequency range recommended for each button. (Right) Illustrating how the station frequency ranges overlap for the various buttons.

tions of coils L_3 and L_6 have been undisturbed—they still serve to couple the oscillator plate and grid circuits together, thus supplying the necessary feedback for proper operation of the oscillator.

Naturally, in a receiver of this kind, the oscillator tuning circuit employed during manual tuning must be adjusted (by means of trimmer C_t and padder C_p) for correct tracking with the preselector circuit employed during manual tuning, over the entire waveband. If manual tuning is provided on more than one band, the proper preselector-osc. tracking adjustments must be made on each of the bands.

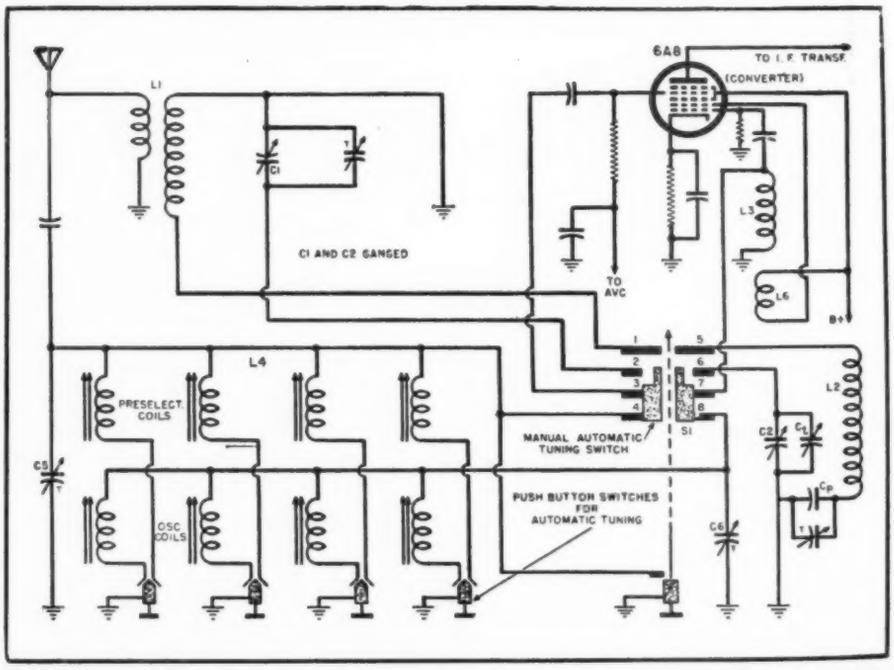
For automatic tuning the pre-setting adjustments made on the individual sets of substitution preselector and oscillator coils used take care of the required frequency difference (tracking) between the oscillator and preselector for each button, so no additional tracking adjustments are required.

The receivers whose tuners are illustrated in Fig. 8 and Fig. 7 also provide both manual and automatic tuning. It will prove instructive for the reader to trace them out for each type of operation. In Fig. 8, capacitors *1* and *2* are the antenna and oscillator tuning sections, respectively, of the 2-gang variable capacitor provided for manual tuning. Capacitors *3* and *4* are their respective trimmers, and capacitor *5* is the oscillator padder.

In Fig. 7, when the manual button is pressed, the manual winding on the relay is energized and the relay returns the circuits in the receiver to the setup for manual operation. The iron-core substitution coils are switched out of the circuit and in their place the usual antenna, interstage and oscillator tuning coils tuned respectively by capacitors *1, 2* and *3* (which are the sections of a 3-gang manually-operated variable tuning capacitor) are switched in. The trimmers of these sections of the tuning capacitor are shown shunting them. Adjustable capacitor *5* is the conventional oscillator low-frequency padding capacitor.

(To be continued)

Fig. 12. Preselector and oscillator tuning circuits of single-band receiver designed for push-button, automatic, iron-core coil tuning, or manually-operated capacitor tuning.



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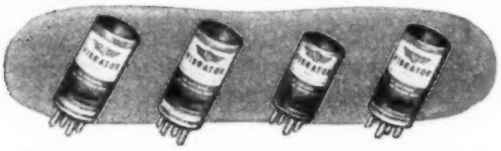

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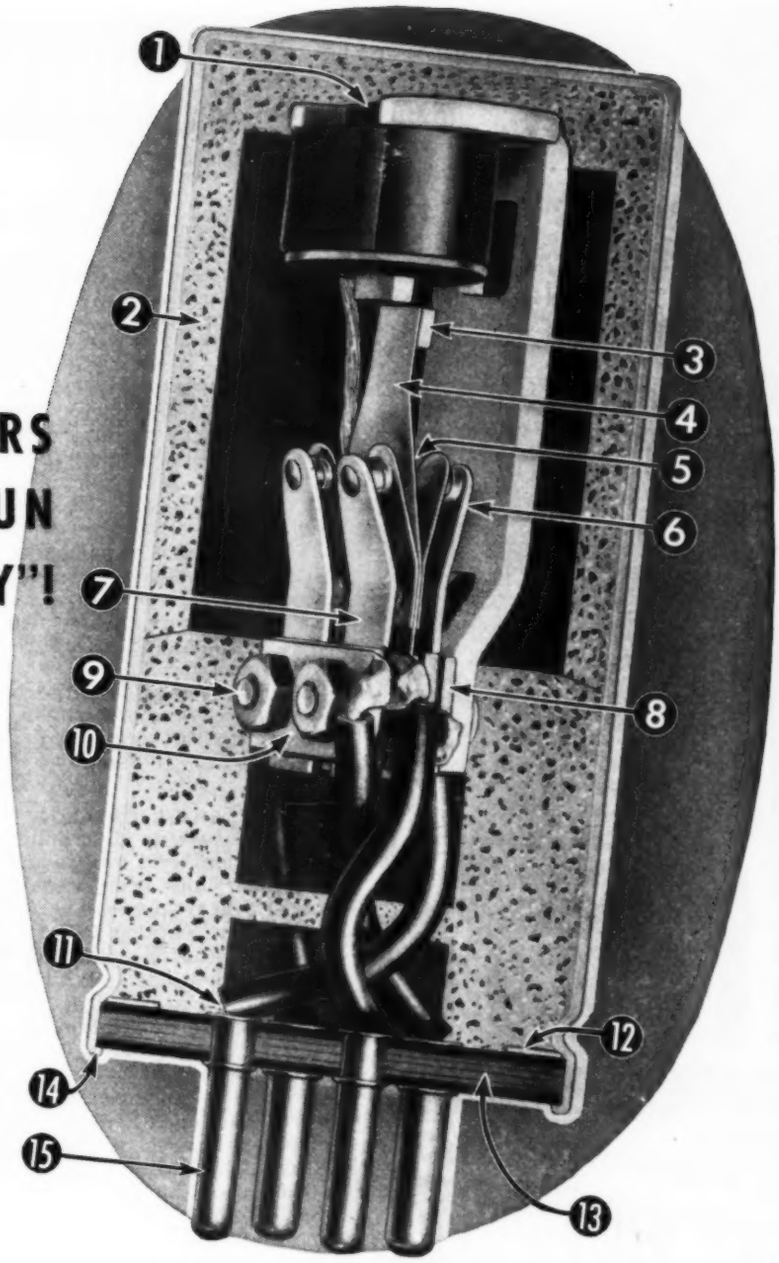

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Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

In view of the present paper shortage, a limited number of copies of the booklets described herein are printed. Manufacturers will endeavor to comply with all requests; however, if your copy is not received after proper request has been made, it most likely will indicate that the supply is exhausted.

REFERENCE MANUAL

A new 24-page reference manual covering complete data on all standard capacitors manufactured by the company has been announced by *The Magnavox Company* of Fort Wayne, Indiana.

This manual is of particular interest to designers and engineers as it contains cross references to standard production numbers, anode size factors, leakage limits, and resistance limits in chart form.

Copies are free of charge, but all requests must be made on company letterhead to *The Magnavox Company*, Fort Wayne 4, Indiana.

SILVER CATALOG

A new catalog describing postwar measurement and communications equipment has been issued by *McMurdo Silver Company.*

This new catalog "Postwar Radio Products" contains data on the first of many new parts, kits, and equipment shortly to be released. Included is a complete description of the company's "Vomax" signal tracer now available without priority. Also described is the new Model 902 Laboratory Capacitance Bridge which represents a postwar combination of Model 901 and 902 Bridges.

A copy of this catalog may be obtained from *McMurdo Silver Company*, 1240 Main Street, Hartford 3, Conn.

CATALOG ON SILICONES

The various properties of silicones are presented in pictorial and descriptive form in the newly-released catalog of the *Dow Corning Corporation.*

The booklet lists the silicone products they have available at present, produced in many forms including compounds, fluids, greases, resins and varnishes, and Silastic, the *Dow Corning* silicone rubber. Special formulations, as well as the main classes of silicone products, are described in the booklet, which also contains charts and graphs demonstrating their various properties.

Inquiries regarding copy of this catalog may be addressed to Mr. O. B. Blessing, Sales Manager, *Dow Corning Corporation*, Midland, Michigan.

TUBES SUBSTITUTION LIST

Taylor Tubes, Inc., announces publication of a substitution list of tubes for diathermy equipment. The listing is expected to be a valuable adjunct to the jobber who sells *Taylor* tubes, as well as of assistance to medical men whose diathermy units may have been standing idle for want of the proper vacuum tube or a satisfactory substitute.

The equipment is listed by manufacturer, and shows the type tube normally furnished with the unit and the proper *Taylor* tube substitute. Designed to alleviate shortages caused by scarcity of tubes of original specifications, the recommended *Taylor* tube substitute is presented.

Available without cost, the leaflet may be procured from your nearest radio jobber, or from *Taylor Tubes, Inc.*, 2312 Wabansia Avenue, Chicago, Illinois.

PEELABLE COATING BOOKLET

Introducing "Liquid Envelope," their peelable plastic coating, *Better Finishes and Coatings, Inc.*, have issued a sixteen-page illustrated brochure describing the use, properties, and technical data of this new type protective packaging.

This plastic film was used as a protective coating upon warplanes enroute overseas, and its peacetime uses are believed to include such applications as the protection of laid-up tools or equipment, as peelable protective coating for finely finished metal, wood, or plastic surfaces during manufacturing operations, and as an easily removed "plastic wrap" for shipping and warehousing.

A free copy of this booklet may be obtained by addressing your request to *Better Finishes and Coatings, Inc.*, 168 Doremus Avenue, Newark 5, New Jersey.

SOUND EQUIPMENT FOLDERS

Two new folders featuring sound equipment units and sound accessories now available have been published by the *Concord Radio Corporation.* Up-to-the-minute catalogs of available equipment covering all requirements, these folders present detailed descriptions as well as illustrations of their complete line of amplifiers, intercommunication systems, recording equipment, and accessories.

"Amplifiers and Boosters" covers models ranging in output ratings of 17 watts to 75 watts a.c. and includes 6-volt units with and without built-in phonograph. "Intercommunication Systems" list models for all require-

ments—master and substation combinations from 2 to 100 stations, including push button control, universal operation, and other features.

The presentation of Recording Equipment includes professional-type units for microphone recording, radio recording, transcription, and public address. Another listing offers sound accessories covering microphones, speakers, and other essential needs.

Copies of the folders may be had by writing to *Concord Radio Corporation* at either 901 W. Jackson Boulevard, Chicago 7, Illinois, or 265 Peachtree Street, Atlanta 3, Georgia.

TUBE CATALOG

A new Hytron Transmitting and Special Purpose Tubes catalog is announced by the *Hytron Radio & Electronics Corporation.* It presents a brief history of receiving, transmitting, and special purpose tubes, illustrating and listing the types of triodes, pentodes, tetrodes, rectifiers, and voltage regulators available, as well as including views of basing diagrams.

For copies, address the *Hytron Radio & Electronics Corporation,* 76 Lafayette Street, Salem, Massachusetts.

MONOGRAPH DISPLAY

To Jensen distributors, the *Jensen Radio Manufacturing Company* offers a combination counter and window display and dispenser for Monographs, the booklets on electroacoustics.

Printed in two colors, the display, measuring 17½ by 21 inches in size, is substantially made of heavy display board. It is easily put together for counter or window display, and pockets are provided for a half dozen copies of each of two Monographs.

Jensen distributors may address requests for displays to the *Jensen Radio Manufacturing Company,* Technical Service Department, 6601 S. Laramie Avenue, Chicago 38, Illinois.

MULTI-CLAMP FOLDER

A folder on the subject of their Diamond G Multi-Clamp has been released by *George K. Garrett Company, Inc.,* listing the sizes available and the corresponding prices. The leaflet describes the construction, application, and use of the clamp, recommending it for heating and cooling systems in automobiles and planes, on waterpipes, for attaching fishing rods to reels, for use on garden hose, in refrigerators, and in a variety of other ways.

A copy of the folder, which should be specified as Bulletin 110, may be secured by addressing Mrs. Hilda R. Dwyer, advertising manager, *George K. Garrett Company, Inc.,* D and Tioga Street, Philadelphia, Pennsylvania.

RADIO COMPONENTS LISTS

Two bulletins listing and illustrating radio components have been issued by the *Alden Products Company.*

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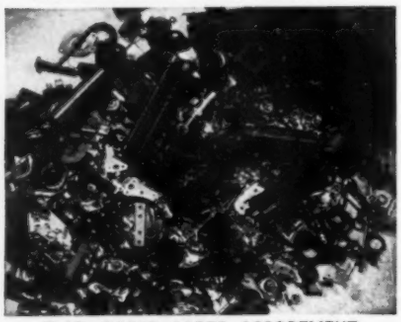

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Published in manual form, *W. C. Dillon & Company, Inc.,* presents the story of the traction type Dynamometer, a precision testing instrument, and its constantly increasing uses in steel, rubber, aircraft, marine, and other industries.

This booklet supplies interesting facts on the development of the Dynamometer, describes and pictures many present day applications. Nine different capacities, which are interchangeable with one another, are illustrated, and description is included of the simplification of weighing and testing procedures achieved through their application.

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BOOKLET ON ADHESIVES

Users of adhesives, sealers, coating or insulating compounds, impregnators, and sound-deadeners will find of interest and assistance the new booklet "3-M Adhesives in Industry," issued by the *Minnesota Mining and Manufacturing Company.*

Adhesive operations in various industries and methods of application are illustrated and described in the 12-page booklet, which also provides a listing of the physical properties. Various formulas are also shown, as well as viscosity, bonding range, color, weight, characteristics, uses, etc. Included in each booklet is an "Adhesive Project Sheet", for convenience in stating individual problems.

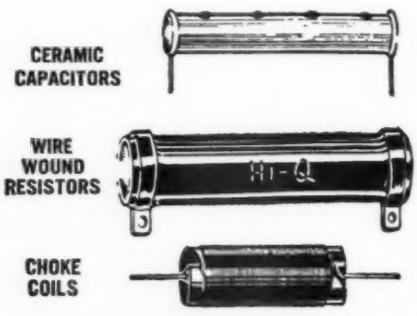
Free copy may be obtained by addressing the Advertising Department, *Minnesota Mining and Manufacturing Company,* Saint Paul 6, Minnesota.

TELEVISION AID BROCHURE

How television will play an important role as an advertising and merchandising medium for department stores is the theme of the new illustrated brochure announced by the *RCA Victor Division* of *Radio Corporation of America.*

The new publication, titled "RCA Victor Television — Opening a New Merchandising Era for Department Stores," indicates how progressive store management can profit by use of video. Various techniques for increasing sales through customers in the store, as well as by means of actual television broadcasts over local stations, are related in the booklet. Also described is the equipment required for the different types of television installations for department stores.

The publication is available to store executives and leaders in the fields of advertising, selling, and marketing,



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Including Frequency Modulation—Television, etc.

Inside Radio Information for all Servicemen—Aircraft Pilots, Students. AUDELS RADIOMANS GUIDE contains 772 Pages, 400 Diagrams & Photos is complete—gives Authentic Principles & Practices in Construction, Operation, Service & Repairs. Covers clearly and concisely Radio fundamentals —Ohm's Law—Physics of sound as related to radio science—Measuring instruments —Power supply—Resistors— Inductors — Condensers — Transformers and examples— Broadcasting stations—Radio Telephony—Receivers—Diagrams —Construction—Control systems— Loud speakers — Antenna systems —Auto Radio—Phonograph pickups—Public Address Systems—Aircraft & Marine Radio—Radio Compass—Beacons—Automatic Radio Alarms—Short Wave—Coil Calculations—Testing—Cathode ray oscillographs—Static Elimination—Trouble Pointers—Underwriter's standards—Units and tables—Frequency Modulation—REVIEW QUESTIONS & ANSWERS, Ready Reference Index.

$4 COMPLETE • PAY ONLY $1 A MO.
Get this practical information in handy form for yourself—Fill in and

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AUDEL, Publishers, 49 W. 23rd St., N.Y.
Mail AUDELS NEW RADIOMANS GUIDE for free examination. If O. K., I will send you $1 in 7 days; then remit $1 monthly until $4 is paid. Otherwise I will return it.

Name _____
Address _____
Occupation _____
Reference _____ R.N.

and may be had upon request to *RCA Victor Division, Radio Corporation of America,* Camden, New Jersey.

MAGNETIC INGOT IRON BOOK

In a 24-page booklet issued by *The American Rolling Mill Company,* they present the various advantages rendering ARMCO Magnetic Ingot Iron particularly suitable for d.c. applications. The product is described as a dense, highly refined open-hearth iron with high conducting power, making it suitable for many electrical and magnetic applications.

One section, titled "How to Fabricate Magnetic Ingot Iron," contains data on the effect of strains on magnetic properties, hot and cold-working, machining operations with the aid of standard tools, and accepted methods of welding, including tables covering best electrodes to use.

For your copy of this booklet, write to *The American Rolling Mill Company,* Middletown, Ohio.

SOUND SYSTEMS CATALOG

Sound systems, amplifiers, musical microphones, intercommunication equipment, projectors, speakers, reproducers, and other postwar products for standard or special applications are featured by the *Mark Simpson Manufacturing Company* in their latest catalog.

The brochure illustrates the latest models as well as including detailed description and specifications on each. The text also highlights special features of the various products, presents information on installation, and gives list prices.

To receive a copy of this 24-page catalog, No. 45, address the *Mark Simpson Manufacturing Company,* 186-194 W. Fourth Street, New York 14, N.Y.

-30-

QTC

(*Continued from page* 43)

erator will prove to be quite satisfactory on both 500 and 8280 kc., with transmitter and receiver and can be completely operated by one man. . . .

ACA also pointed out that radar equipment should be required on all compulsorily equipped ships. A loudspeaker should be provided in the shack for keeping watch on 500 kc. when copying on another frequency. Keying relays, to be inclosed, and doublet or other feeder lines which are installed, should be in shielded runs to prevent pickup. There are sugges-

ERRATUM

It has been called to our attention that an error appeared in the code speed requirements for radio-telegraph licenses appearing in "QTC" (page 50) of the September issue of RADIO NEWS. *It was stated that a speed of 20 w.p.m. in plain language is required for the 2nd-class radio telegraph licenses. Such is not the case; the code requirements should have specified 16 w.p.m. in code groups. There are no requirements for plain language for this class of license.*

Depend on Permoflux for Better Acoustical Reproduction

The many specialized Permoflux designs and engineering developments that have so notably demonstrated their superiority in wartime applications are available to improve the performance of your peacetime products. Why not consult specifically with our representative on your own problem?

TRADE MARK

PERM-O-FLUX

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PIONEER MANUFACTURERS OF PERMANENT MAGNET DYNAMIC TRANSDUCERS

110-VOLTS AC from DIRECT CURRENT

with KATO KONVERTERS. Furnish standard 110-volt AC from 32, 110, or 220-volts DC. Good deliveries on sizes 350 through 1500 watts.

PIONEERS IN THE BUILDING OF SMALL ROTARY CONVERTERS

Katolight Rotary Konverter, 225 Watt

Good deliveries on 5, 7½, 15 and 25 KW AC generators. Mfgr.'s DC generators, motor generators, frequency changers, high frequency generators.

Special motors and generators 25 to 800 cycles.

KATO ENGINEERING CO.
120 Rock Street Mankato, Minnesota

tions for the revision of operator licenses and other additions and changes in the equipment, lighting, rooms, etc., some of which are very good suggestions. We suggest you boys in ACA give this matter a good bit of time and a "good think." ACA wants your comments regarding its postwar plan.

Most marine radio men will agree that the standard of the equipment aboard the merchant fleet should be maintained at a high level. The equipment aboard many ships of the American merchant marine, just before the war was a disgrace, with old detector-amplifier receivers without r.f. stages. Good communications receivers were unheard of aboard ship up until just prior to the war. Even the tube transmitters aboard many ships were old, converted units which had seen years of service as spark transmitters.

American President Lines is up for bid by Maritime Commission at this writing. . . . Size of postwar Navy is still up to Congress which at this time has made nothing definite in actions but has announced that plans of both Navy and Congress are for a 1079 ship Navy of between 4 and 5 million tons. 73

What's New
(*Continued from page* 74)

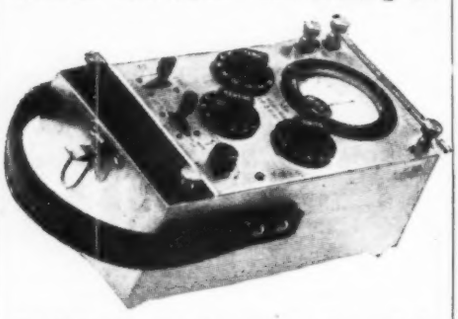
eral type soldering, and HF150 for heavy duty work.

Further information may be obtained from *Baker-Phillips Company*, 3059 Lyndale Ave. So., Minneapolis 8, Minn.

LINEMAN'S BRIDGE

A small bridge, rugged and compact enough to be carried easily, has been designed to meet the requirements of the telephone and telegraph lineman by the *Nilsson Electrical Laboratory, Inc.*, of New York.

Weighing only five pounds complete, and measuring 9"x5"x4½", this bridge is used to measure the resistance of wires as well as the unbalance between two wires. The reading on



the loop can be changed to the unbalance reading without disturbing the connections and can be done in a few seconds by throwing a switch and changing the position of the three decade dials. The switching arrangement also designates which wire is of the higher resistance.

The range of measurement is up to 111 ohms in steps of one-tenth of an ohm with an accuracy of one-quarter

For Soldering in Tight Places . . .

DRAKE

No. 400 Soldering Iron

Smallest Industrial Iron Ever Designed
60 Watts—¼ in. Tip
Only 9 in. long—Wt. only 8 oz.

This mighty mite is backed by DRAKE'S 25 years of soldering iron manufacturing experience. The high quality and long service of DRAKE Soldering Irons have made them outstanding favorites with all types of radio men everywhere. The DRAKE No. 400 is an outstanding value at

Only $4.50 List

Drake Has an Iron for Every Purpose Ask Your Radio Parts Jobber.

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RADIO ENGINEERS

Our post-war expansion program requires additions to our staff.

We offer excellent opportunities to radio engineers who have had extensive experience in circuit design. FM and television experience is especially desirable.

A good post-war future for those with proven ability.

Please write, describing your educational and technical background, and experience in detail.

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RECORD PLAYERS

COMPLETE—SIMPLY INSTALL YOUR OWN MOTOR AND TURNTABLE!

Record Player Complete without motor & turntable **$32.50** per unit

PLAYER CONTAINS: *All Components Mounted, Wired and READY TO PLAY*

- Large electro-dynamic speaker
- Tone Control • Volume Control
- A. C. Amplifier with power transformer, and connecting cords
- 3 tubes—1-6V6, 1-6C5, 1-5Y3
- Astatic pickup with arm rest
- Permanent needle—Knobs
- Acoustically-built cabinet
- All in a handsome, leatherette-covered, sturdily-constructed case, 14" wide, 7½" high, 16¾" long.

DEALERS—Write for quantity discounts!

UNION RADIO CORPORATION
1636 W. VAN BUREN ST., CHICAGO 12, ILL.

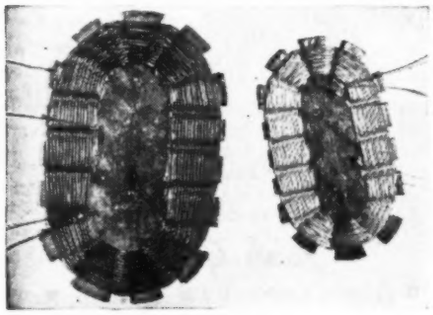
of one per-cent. The galvanometer, which is a Weston Model 375, has a sensitivity of approximately 22 microamperes per division for 30 divisions. Batteries are standard 1½ volt flashlight cells. This bridge can also be used as a general-purpose bridge up to the limit of its capacity.

Further details on this new bridge may be obtained by writing directly to the *Nilsson Electrical Laboratory, Inc.*, 103 Lafayette Street, New York 13U, New York.

LOOP ANTENNA

South Shore Radio & Electric Company of Chicago has announced the development of a new loop antenna for broadcast receiver use.

Featuring the use of polyethylene wire, the loop is reported to have exceptionally high Q, typical values being 200 to 250 for the broadcast band, and holds up well at the high frequency end of the band where the tendency for most loops is to drop off badly. In some designs the Q actually rises with frequency.



Available to manufacturers' specifications, the loop is manufactured by the *South Shore Radio & Electric Co.*, 6815 Stony Island Ave., Chicago, Illinois.

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Within the Industry

(*Continued from page* 66)

nograph division. Mr. Greenbaum was formerly general sales manager of *Packard Manufacturing Corporation* in Indianapolis, and prior to joining *Aireon,* was regional chief of manpower utilization with the WMC in Kansas City.

Jack Kaufman, formerly president of *Heintz and Kaufman Limited* and engaged for a number of years in electronics in San Francisco, has also been named a vice president. Mr. Kaufman, who only recently joined *Aireon* to head its new San Francisco office, is a senior member of the Institute of Radio Engineers and was president of the West Coast Electronics Manufacturers' Association, San Francisco Council.

Announcement is also made of the appointment of Kenneth D. Halleck, Washington sales representative, to the corporation's Board of Directors. Mr. Halleck will move to the company's headquarters in Kansas City as administrative assistant to A. E. Welch, executive vice president, and *Aireon* Washington offices will continue in their new address at 1108 16th Street, N.W.

* * *

INTERNATIONAL DETROLA CORPORATION has sold its Indianapolis machine tool plant and equipment to *F. L. Jacobs Company* of Detroit. Production and servicing of Libby Turret Lathes has been transferred to the company's Elkhart, Indiana, plant.

* * *

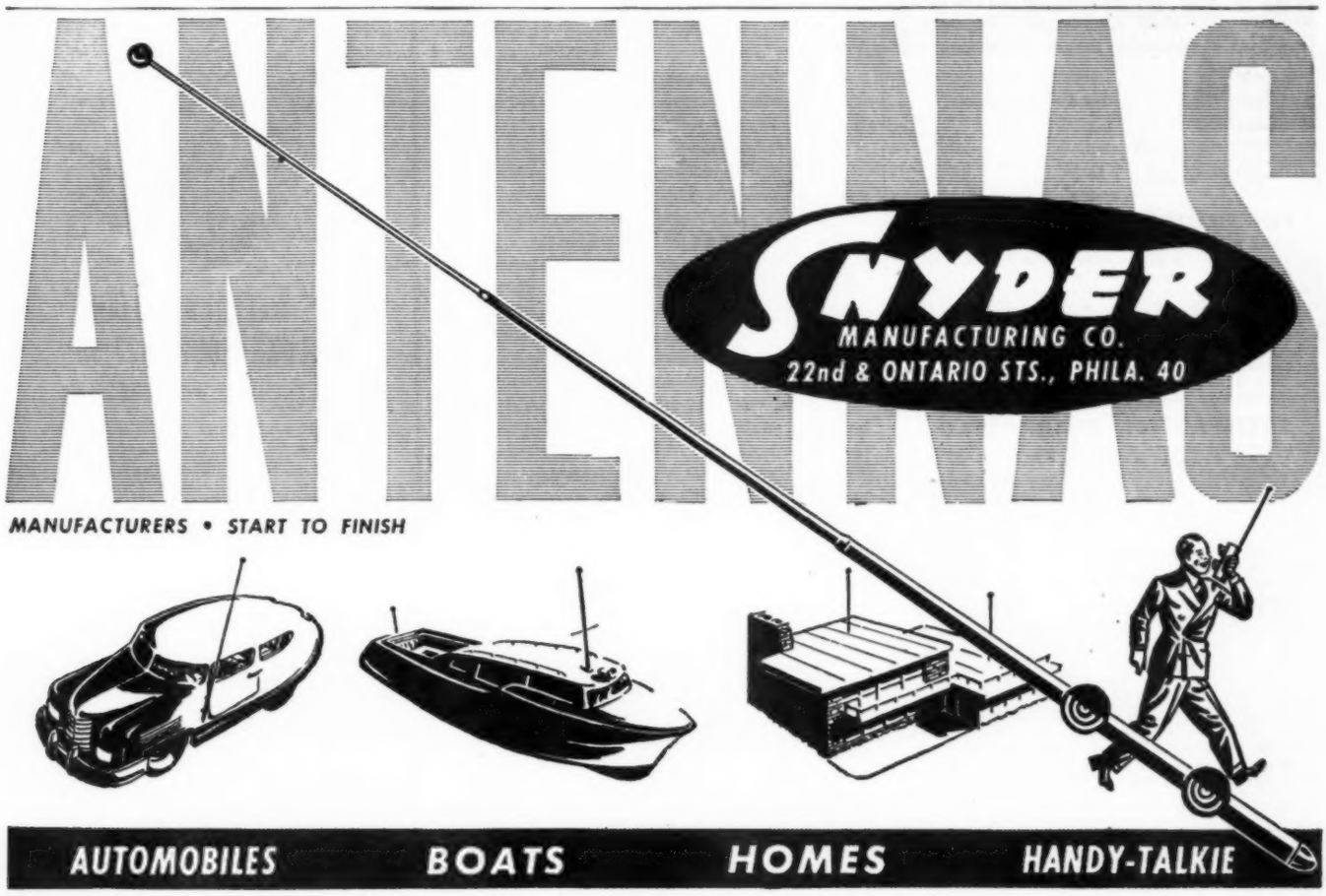
TED McELROY, president of the *McElroy Manufacturing Corporation* of Boston and world's champion radiotelegrapher, has rejoined the merchant marine as Radio Operator Lieutenant Sr. Grade. Lt. McElroy is now making the regular run between Europe and the United States.

* * *

COLONEL GEORGE P. DIXON, who was Chief of Air Communications for all United States Air Forces in the European Theater of Operations, was recently elected a vice president of the *International Telephone and Telegraph Corporation.*

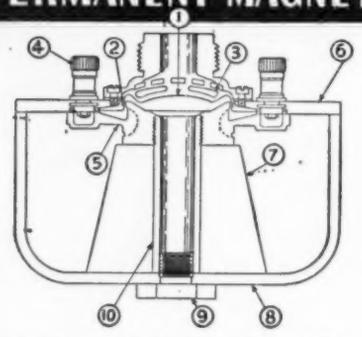
Colonel Dixon joined the *Pacific Telephone and Telegraph Company* in 1912 as a traffic engineer. He left that company to serve in World War I and after the Armistice, remained overseas for a year in charge of all Army telephone service in France and Germany.

Following World War I, Colonel



Inside Facts About

ROWE No.7 PERMANENT MAGNET



1—One-piece metal diaphragm. Voice coil wound on diaphragm.
2—Horn mounting accurately centered.
3—Perforated die-cast palate
4—Cadmium plated heavy-duty binding posts.
5—Flange molded to inner pole piece.
6—Outer pole piece of special alloy.
7—Heavy ALNICO permanent magnet.
8—Bowl of heavy gauge steel.
9—Brass assembly nut binds all parts.
10—Inner pole piece made of brass.

Write for circular RN-12 giving complete details.

ELECTRONICS DIVISION

ROWE *Industries*

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FIX ANY RADIO

Amazing New Invention

Learn to repair radios in minutes instead of hours. Revolutionary, different **Comparison** technique permits you to do expert work almost immediately. Most repairs can be made without test equipment or with only volt-ohmmeter. Simple point-to-point, cross reference, circuit suggestions locate faults quickly and easily. You may try the plan without any risk or obligation.

FOR BEGINNERS OR EXPERTS

Find any radio fault with ease. Follow the comparison tests given on 24 trouble-shooting circuit blueprints. 76 fact pages. Over 1,000 practical repair hints. Hundreds of simplified tests using a 5c resistor and a filter condenser. Covers every radio set—new and old. Introductory material for beginners and to serve as a review for experienced radio men. Also several chapters on test equipment. Presented in manual form, 8½ x 11 inches. Entire plan is stark new and will change servicing methods. Used in schools, Armed Forces, and by thousands of radiomen.

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Take advantage of our "no-risk" trial. Send coupon today. Use this time-saving money-making radio servicing method for 10 days without any obligations. See how much time you will save every day on every radio job. Learn new short-cuts in radio servicing. Then decide to keep **Comparison Method Manual** or return it and receive a cash refund. You cannot lose—but you owe yourself a chance to look at this plan. **Price, complete only $1.50.**

Developed by M. N. Beitman, radio engineer, teacher, author and serviceman

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The training will more than pay for itself on the first radio job. Examine and use this unique plan for 10 days at our risk. Send coupon right now—receive and use the plan this week.

***NO RISK* TRIAL COUPON**

SUPREME PUBLICATIONS, 9 S. Kedzie, Chicago 12, Ill.

Ship the new manual, **Simplified Radio Servicing by Comparison Method,** for examination. I am enclosing $1.50, full price, send postpaid. I must be satisfied or you will refund my money.

NAME:.....

ADDRESS:.....

Dixon joined the engineering department of the *International Western Electric Company,* and in 1926 was made district manager of the Manhattan area of the *New York Telephone Company.* Three years later he was appointed communications engineer of the National City Bank of New York and its associated institutions and bank branches throughout the world. Colonel Dixon was called to active duty again in September 1940.

—30—

Microfarad Meters

(Continued from page 47)

$$(3)\quad X = \sqrt{\left(\frac{E}{I}\right)^2 - (R + r)^2}$$

where X is the capacitive reactance (ohms),
E, the applied voltage (volts),
R, the external multiplier resistance (ohms),
r, the internal meter resistance (ohms)
and:

$$(4)\quad C = \frac{10^6}{6.28f\sqrt{\left(\frac{E}{I}\right)^2 - (R + r)^2}}$$

Where C is the test capacitance (μfds.),
f, the test-voltage frequency (cycles-per-second),
E, the applied test voltage (a.c. volts),
I, the meter deflection (a.c. amperes),
R, the external multiplier resistance (ohms),
r, the internal meter resistance (ohms).

The milliammeter scale may be graduated in microfarads by means of points obtained through use of equations (3) and (4).

If the test capacitor has a series resistance component, as it must have when its power factor is a readable value, the meter deflection will not be proportional to reactance alone but to impedance, the vector sum of reactance and resistance. If the resistance is large, with respect to the reactance, the capacitance indication will be in error. The resistive component is not easily determined, except by means of a bridge measurement of power factor; hence, the error introduced by equivalent series resistance usually will not even be suspected by the user of the microfarad meter.

The a.c. ohmmeter-type of microfarad meter, as illustrated by Fig. 2, has a forward-reading scale; that is, the capacitance scale reads from left to right. For large capacitance (low reactance) values, the test capacitor may be connected in parallel with the indicating meter. This is the same scheme employed with d.c. ohmmeters used to measure very low resistance. The separate meter scale required for

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THIS MONTH'S SPECIAL

VOLT-OHM MILLIAMMETER

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Illustrated
•
Weston Analyzer
Model 772 type 6
$49.50 net
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Jack Greene

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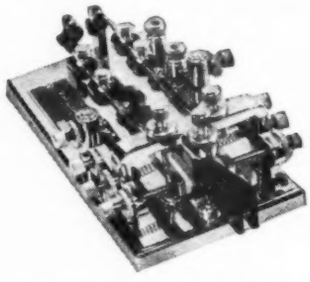

THE MELEHAN VALIANT DE-LUXE MODEL $27.50

EXCLUSIVE FEATURES

• • Automatic dots PLUS automatic dashes • • series of dots formed when thumb moves handle to right; series of dashes formed when forefinger moves handle to left • • Purely mechanical in operation, self-contained and self-sufficient • • Complete speed coverage from fifteen to eighty words per minute • • Outstanding in design and craftsmanship • • Completely chromed • • Base 4 x ½ x 7 • • Shipping weight 7½ pounds • • Satisfaction guaranteed on a full money-back basis • •

MELVIN E. HANSON

(W6MFY)

MELEHAN RADIO 821 Main Street

HUNTINGTON BEACH, CALIFORNIA

the parallel connection will read from right to left (*backward-reading*).

Before checking a capacitor, the ohmmeter-type of microfarad meter must be set to zero. This is done by connecting together temporarily the test capacitor terminals and adjusting either the test voltage or the external resistor, R, until the pointer of the meter is at full scale for the series connection, or at meter zero for the parallel connection. Several capacitance ranges may be provided by shifting the test voltage value. Each voltage value will be in decade relation to the others, for easiest reading of the scale.

Both scales of this meter tend to crowd at higher-capacitance ends. This reduces the accuracy of reading so much that the range should be selected so that a capacitance value will be read on the open portion of a scale.

In one of the commercial versions of this type of microfarad meter, a fixed capacitor is used in lieu of the multiplier resistor, R. This tends to preserve the proper phase relationship between current and voltage in the circuit.

It may be noted from equations (3) and (4) that both frequency and voltage, together with capacitance, govern the meter deflection. Here again, it becomes necessary to maintain the values of these quantities steady in order to duplicate readings.

Ratio Meter

The professional microfarad meters commonly employed for spot checking capacitance in capacitor factories and in electrical laboratories are of the so-called *ratio meter* type. These are dynamometer instruments. Fig. 3 illustrates the arrangement of this type of meter.

L_3 and L_4 are two coils fastened together so as to rotate together, with their planes perpendicular. The pointer of the meter is attached to this coil assembly which has no return springs. The assembly rotates on pivots in jewelled bearings within the field of two stationary coils, L_1 and L_2. In the diagram, the fixed and movable coils are shown connected in parallel, although in low-frequency instruments they may be wired in series.

The a.c. test voltage is applied to the coils in series with an accurately-known internal standard capacitor, C_s, and the externally-connected unknown capacitor, C_x. When no unknown is in the circuit, coil L_3 sets itself in the plane of the stationary coils, the position of meter zero. When C_x is connected, however, the current flowing in the movable coil sets up an opposing torque which is proportional to the capacitance of C_x, and this torque causes a rotation of the L_3-L_4 assembly and a movement of the pointer along the microfarad scale.

This type of microfarad meter is more reliable than the simple types described previously. Its common disadvantages will be pointed out later. Usual accuracy ratings are 1% of full scale below .3 μfd., and ⅓% of full

NEW YORK'S LEADING RADIO SUPPLY HOUSE

TERMINAL RADIO for SERVICE VALUES COMPLETE STOCK

Here are some typical TERMINAL SPECIALS! We carry one of the largest stocks of standard electronic equipment for receiving, transmitting and industrial use. No priorities required!

MEISSNER Midget AC-DC RADIO KITS

Here is the ideal radio kit for beginners! Furnished complete with punched panel and chassis, dial, broadcast band plug-in coil, knobs, condensers, resistors, wire, solder, hardware and full instructions for easy assembly! Loud and clear earphone reception! Uses type 76 tubes and operates on 110 volts AC or DC. Supplied less tubes and earphones.

2 tube Radio Kit, as described $5.02
Kit of 2 tubes for above 1.08
3 tube Radio Kit, as described $5.75
Kit of 3 tubes for above 1.62
Acme Double Headphones $1.49

TERMINAL PUBLIC ADDRESS SPEAKERS

No finer PM speakers made for these prices—they're tops in quality! Conservatively rated; peak wattages are 50% above normal ratings given here!

Type No.	Size	Cont. Watt.	Net Price
*TFP820	8"	10	$6.91
T12P	12"	8	6.61
TPM12-18	12"	10	8.23
*TFP1220	12"	13	9.40
TG12P	12"	17	14.25
TGS12P	12"	20	20.43
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*Wide range frequency response

BRUSH PL-20 Wide-Range CRYSTAL PICKUP

Complete with equalizer and factory-installed permanent sapphire stylus.. $26.46

CARTRIDGE ONLY, Type PL-2Z $8.82
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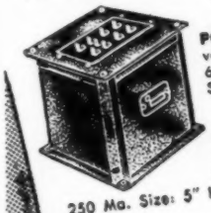
TRANSFORMER Specials!

Fully cased and shielded.



POWER TRANSFORMER — Type TR589. AC voltage: 300-0-300 volts @ 125 Ma. DC., 6.3 volts @ 4.5 amps., 5 volts @ 3 amps. Size: 5" H x 3⅞" W x 5" L.
Special $4.95

PLATE TRANSFORMER—Type TR501. AC voltages 625-0-625 or 500-0-500. 40 volt bias tap. DC voltage after filter 500 or 400 volts @ 250 Ma. Size: 5" H x 4½" W x 5" L.
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FILAMENT TRANSFORMER—Type TR540. 5 volts AC @ 8 amps. Insulation voltage—2500 volts. Size: 3⅞" H x 3" W x 4½" L.
Special $3.49

FILAMENT TRANSFORMER—Type TR547. 10 volts AC @ 4 amps. Insulation voltage—5000 volts. Size: 3⅞" H x 3" W x 4½" L.
Special $2.98

OUTPUT TRANSFORMER—Kenyon T-110. 60 Watt Universal Type. Matches any tube load to 500-200 ohm line or speaker voice coils ranging from .5 to 25 ohms. Size: 5" H x 3⅞" W x 5" L.
Special $7.06

TERMINAL Radio Replacement SPEAKERS

Completely dustproofed, high quality dynamics.

Size	Field Ohms
4"	3000
4"	450
5"	2750
5"	450

Your cost $1.81 Each

Universal Output Transformer for above ..... 88¢

25% DEPOSIT Required with C. O. D. Orders

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MONEY-SAVING SPECIALS

Immediate Delivery. Orders filled same day received

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Knee type. Strong spring holds securely. Black enamel and brass finish. Complete with plug and cord. Limited supply. Order now. Only—$2.25.

DESK TYPE KEY—$1.69

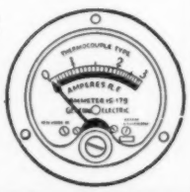
Cadmium plated. A good practice for amateurs.

PL-55 PLUG—34c

A high grade, dependable plug.

G. E. AMMETER

General Electric Thermocouple R. F. type—only $4.95.



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Tubes . . . test equipment . . . meters . . . cords and cables . . . condensers . . . resistors . . . switches . . . speakers. Write for bulletin listing hundreds of items.

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CAPACITORS —
OIL, PAPER and ELECTROLYTIC

Illinois
CONDENSER COMPANY
1160 N. HOWE ST. • CHICAGO 10, ILL.

scale at .3 μfd. and higher. The instrument is made regularly for use on 50, 60, and 500 cycles-per-second at r.m.s. voltages of 100 to 130 and 200 to 250. The 60-cycle, 100-130-v. instrument draws approximately 150 milliamperes; the 500-cycle, 100-130-v. meter, 350 milliamperes; and the 500-cycle, 200-250-v. meter, 200 milliamperes.

In spite of its refinement, this type of instrument is not entirely independent of test voltage, power factor, and frequency values. *Weston* recommends, in order to obtain guaranteed accuracy with its Model 372 microfarad meter, that the phase angle of the capacitor under test must not exceed 3 electrical degrees. The input voltage may swing between 100 and 130 volts or between 200 and 250 volts, depending upon the rating of the instrument, and the low-frequency models (50 and 60 cycles-per-second) will tolerate a 10-cycle frequency change.

Ratio meters are supplied for a rather wide capacitance coverage. However, they have the pronounced disadvantages, as far as electrical maintenance and repair shops are concerned, that they are heavy and bulky and are expensive.

Heterodyne Capacitance Meter

The heterodyne capacitance meter, illustrated by the block diagram of Fig. 4, is not so widely used at present as are other types. But this type gives promise of increased future development, simplification, and application. In its present form, it is rather bulky and is found mainly in precision laboratories. We have reason to expect that miniature tubes and batteries, zero- and negative-drift capacitors and resistors, and miniature tuning gear will make possible a portable heterodyne capacitance meter having no greater physical dimensions than present microfarad meters.

The same operating principle employed in the heterodyne capacitance meter is the basis of operation of several other electronic instruments. The arrangement consists of two identical low-frequency r.f. oscillators, one fixed in frequency and the other variable, feeding the input circuit of a demodulator. The demodulator output voltage is presented to an audio-frequency amplifier which in turn drives an indicating audio-frequency meter.

As long as the two oscillators are operating on the same frequency, the demodulator delivers no beat-note voltage to the amplifier, and the meter remains at zero. The variable oscillator may be set for this zero beat condition. When the frequencies no longer coincide, however, a beat note equal to the frequency difference actuates the frequency meter. If a capacitor, C_x, of unknown value is connected externally in parallel with the tank circuit of the variable-frequency oscillator (which previously has been set to zero beat with the fixed oscillator), the variable oscillator frequency will be shifted in proportion to the capacitance. The resulting beat note will be

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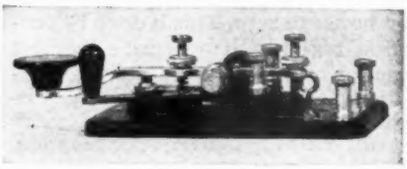

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indicated by the frequency meter. The scale of this meter accordingly may be graduated in micromicrofarads, rather than in the usual cycles-per-second.

The heterodyne-type capacitance meter has the present disadvantage that its capacitance range is rather limited. However, it is an excellent instrument for measuring small capacitances with extreme accuracy. Such capacitances lie between 1 and 1000 $\mu\mu$fd. The instrument may be made very stable by means of rugged mechanical construction and temperature-controlled oscillators. Operation of the frequency meter portion of the circuit may be made independent of voltage and waveform over a wide range. The accuracy of a microfarad meter of this type is only negligibly affected by the power factor of a capacitor within its range of measurement.

This instrument has been presented here because it undoubtedly points the way to modern, foolproof microfarad meter development. In its present form, however, it is not a rough shop-type tester.

-30-

Spot Radio News

(*Continued from page* 14)

them into commercial products. The first GE receiver samples will become available by the end of January."

"Color television studio equipment is already being manufactured, and ten units have been sold to date," Dr. Goldmark added.

Ghosts—television's counterpart of the echo in radio—have been eliminated, according to Dr. Goldmark, from the color-television broadcasting. An inexpensive directional antenna and the use of the high-frequency television bands brought about *ghost-free* reception for the first time in television history.

OPA REVISED CEILING PRICES finally got more or less nailed down early in the fall, after some six weeks of backing and filling by all concerned. Although no shouts of approval have been heard from the industry concerning the new set-up, rumbles of protest were heard only faintly on the horizon and were nearly drowned out by the roar of factory wheels going top speed at postwar production.

For the record, the old and new increase factors for radio tubes and parts are shown in Table 1.

The manufacturer, to calculate his ceiling price for a radio tube or part sold for use as original equipment, takes his 1941 October 1-15 price for the part and multiplies by the increase factor. The sum of the resulting figure and the 1941 October 1-15 price is the manufacturer's reconversion ceiling price.

Increase factors for radio sets were also announced by OPA as 15 per-cent up for radios selling to wholesalers up to $11, 12 per-cent up for radios in the

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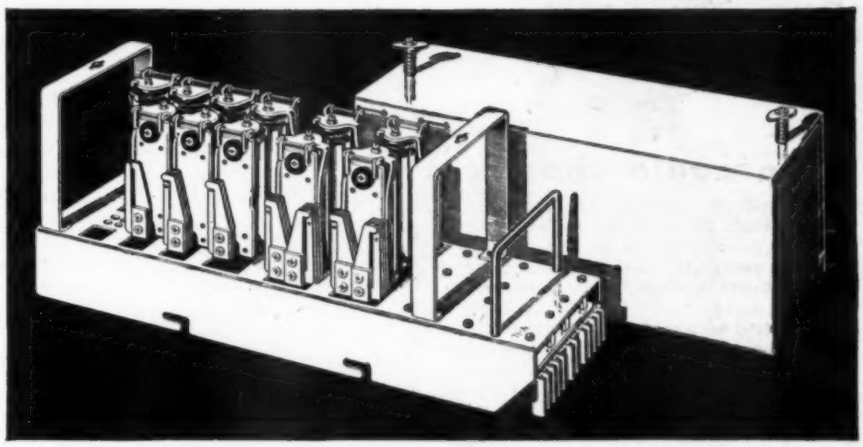


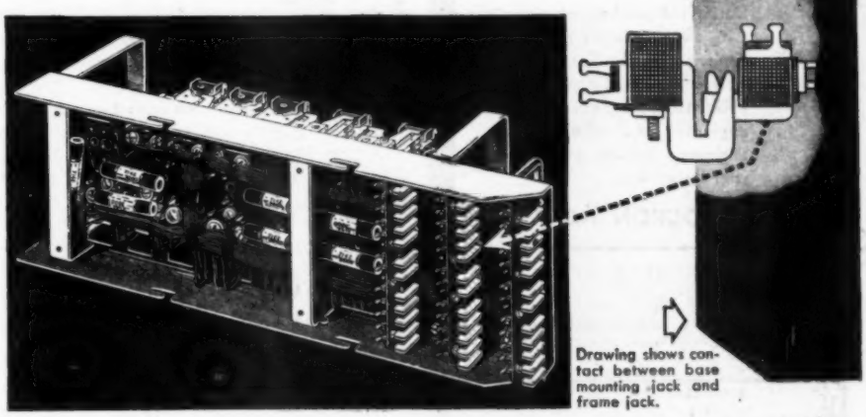
Pictured here is a typical Clare Relay Mounting Base with built-in connector strips. This method of mounting relay components provides greatly simplified maintenance, permits a complete bank of relays to be removed at any time for easy readjustment or replacement.

Under side of the mounting base, shown below, illustrates the wiring and three 24 point base connectors. The bayonet slots shown on the side of the base are locked into protruding frame pins, allowing the base connectors to be aligned with the frame connectors. This also provides a mechanical mounting of the assembly and relieves any stress on the connectors.

The 24 point jacks shown are made of nickel silver and make a firm friction contact with the frame jack. Insulation between jacks is linen base bakelite which provides good mechanical and electrical characteristics.

In keeping with the Clare principle of "custom-building", various sizes of mounting bases are available and special bases are easily provided. Standard jacks are: 12, 16, 20, 24 and 32 point sizes.

Call on Clare engineers to assist you with standard or special mountings in keeping with the requirements of your design. Address C. P. Clare & Co., 4719 West Sunnyside Avenue, Chicago 30, Illinois. Sales engineers in principal cities. Cable address: CLARELAY.



Drawing shows contact between base mounting jack and frame jack.

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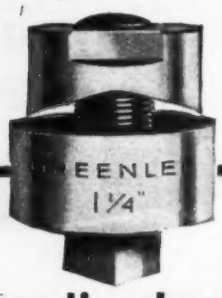

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$11-$30 price range, and 10.5 per-cent up for everything over $30. These are for radios comparable to those sold from July through October, 1941.

Personals

Justin Miller, new president of the *National Association of Broadcasters,* came in for unprecedented praise from the Federal Communications Commission when he took over his new office. In a formal news release, FCC led off with: "The Federal Communications Commission believes that the National Association of Broadcasters has exercised great wisdom and discrimination in the choice of Justin Miller as president and looks forward to constructive and harmonious relationships on an even broader basis than heretofore." . . . FCC Chairman **Paul A. Porter** was the principal speaker at President Miller's inaugural dinner in Washington. . . . President **R. C. Cosgrove** of the *RMA* recently announced **F. L. Granger** of the *Stromberg-Carlson Company,* Rochester, N. Y., as chairman of the association's Service Committee. Other members: **J. M. Bowmaster,** the *Sparks-Withington Co.;* **W. O. Bruyere,** *Colonial Radio Corp.;* **W. H. Campbell,** *Farnsworth Television & Radio Corp.;* **Harry A. Ehle,** *International Resistance Co.;* **Howard Hull,** *Galvin Manufacturing Corp.;* **W. L. Jones,** *RCA Victor Division;* **Harry Kalker,** *Sprague Electric Co.;* **H. R. Kreutter,** *General Electric Co.;* **C. W. Miller,** *Westinghouse Electric Corp.;* **H. A. Newell,** the *Crosley Corp.;* **E. S. Riedel,** *Raytheon Manufacturing Co.;* **M. J. Schinke,** *Admiral Corp.;* **Frank E. Smolek,** *Zenith Radio Corp.;* and **Ray F. Sparrow,** *P. R. Mallory & Co., Inc.* . . . Another recent *RMA* organizational change created a new Speaker Section in the Parts Division, of which **R. C. Sprague** is chairman. Speaker Section chairman is **George R. Haase** of the *Operadio Company,* St. Charles, Ill. Another new Speaker Parts Section, with **A. D. Plamondon, Jr.,** of the *Indiana Steel Products Company,* Chicago, as chairman, is also announced. . . . *RMA's* Transmitter Division, **C. J. Burnside** of *Westinghouse Electric Corp.,* Baltimore, chairman, has been reorganized, with the following section chairmen appointed: **E. H. Fritschel,** *General Electric Co.,* Schenectady, chairman of the Transmitter Tube Section; **R. E. Samuelson,** of the *Hallicrafters Co.,* Chicago, chairman of the Marine Section; **F. C. McMullen,** of the *Westinghouse Electric Co.,* New York, chairman of the Aviation Section; and **H. F. Mickel,** of *RCA Victor Division,* Camden, N. J., chairman of the Emergency Service Communications Section. **George E. Wright** of *Bliley Electric Co.,* Erie, Pa., was reappointed chairman of the Piezo-electric Quartz Crystal Section, and **C. W. Miller** of the *Westinghouse Electric Corp.,* Baltimore, remains as chairman of the Broadcast Transmitter Section. . . . **Frank S. Horning,** chief of the Field Service Branch,

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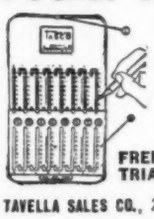

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WPB Radio and Radar Division, resigned recently to become Pacific Coast representative for *Radio & Television, Inc., New York.*

—30—

Video Circuit

(*Continued from page* 50)

a d.c. voltage as well as an alternating voltage is transferred to the grid of the next stage), biasing the tube so that the screen is essentially dark.

When signal is applied, the bias on the grid of the video output tube rises according to the content of the signal. The smaller the picture signal content (brighter the scene), the higher the bias becomes. Thus, the higher bias permits less average plate current flow and less negative voltage transferred to the picture tube grid, which causes the screen to brighten according to the average brightness of the scene. Likewise, instantaneous variations appear on the grid of the picture tube, taking care of the relative light distribution.

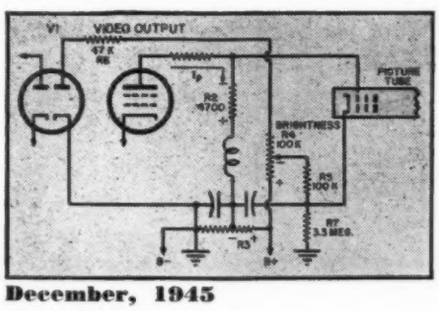
The bias on the picture tube grid, Fig. 7, is the algebraic sum of the voltage drops between grid and cathode. Positive bias is presented by resistors R_3 and R_4, negative by R_1 and R_2. The bias voltages across R_3, R_4, and R_5 are fixed; the bias voltage across R_2 is dependent on the grid bias on the video output tube. The value of the fixed bias applied to the cathode is determined by the setting of the brightness control. This is the control which is adjusted until the signal blanking and black-out bias levels coincide.

A positive bias is applied to the tube as long as the diode V_1 conducts, for resistors R_4, R_5, and the diode form a bleeder across the power supply. Whenever the diode stops conducting, the voltage across the power supply appears almost in its entirety across R_7 and, consequently, the picture tube is cut off. Diode V_1 is, therefore, a safety device to prevent instant application of positive bias to the picture tube grid (causing an intense injurious spot to appear on the screen), until the video output tube draws sufficient current through R_2 to develop the required negative voltage.

Brilliance and Contrast Controls

The brilliance control R_4 is shown in Fig. 7. It sets the fixed bias applied to

Fig. 7. Picture tube bias system.



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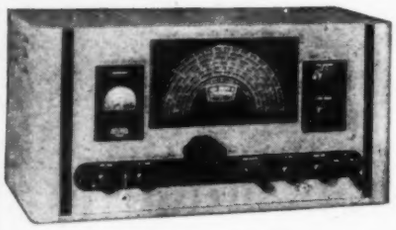

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the picture tube grid and, therefore, controls the average illumination of the screen. This control must be properly adjusted when the station is tuned in.

The contrast control is comparable to the r.f or audio gain control of the ordinary broadcast receiver. In the model 90 receiver, the contrast control is in the cathode circuit of the video amplifier. In other installations, the contrast control is often found in the cathode circuits of the i.f. tubes. The contrast control sets the peak amplitude of the picture signal applied to the picture tube control grid. If it is set too low, or the signal is weak, the picture on the screen does not have the proper light range (dull appearance); if it is too high, the picture saturates (improper black to white gradations).

Restoration Methods

Two other methods of d.c. re-insertion are shown in Fig. 5. The first of these methods uses a diode in the input circuit of the picture tube. When no signal is applied, the picture tube is biased to cutoff by the voltage drop

PW CONSTRUCTS CONCEALED RECEIVER

A STORY of the ingenuity of an American engineer who managed to construct and conceal a tiny radio set by means of which he and his fellow-prisoners kept in touch with the world outside, has just come from a prison camp in Java.

The radio builder was Gaylord A. Buchanan, 28, of 225 Main Street, Claysville, Pa. Buchanan lost his leg during his third year at the U. S. Naval Academy, Annapolis, but was permitted to complete his course there. After graduation he went to work for the Sperry Gyroscope Company, which sent him to Singapore. He escaped the Japanese during their occupation of that city but later was captured in Java.

Obtaining two small RCA acorn tubes from a New Zealand Air Force officer in the prison camp, Buchanan salvaged other parts from a wrecked Philips Radio and then, with a charcoal fire, copper, and plexiglas, built the set into an aluminum cup which he fitted into a recess hollowed out of his artificial leg.

Apparatus for rectifying the current and cutting its voltage was built into part of a Dutch canteen. A wire supporting a mosquito netting bar in his quarters was used for an aerial.

When the first set of the radio's tubes blew out, Lieut. Louis Emil Biechlin, U.S.N., of R.F.D. Box 102, South Akron, Ohio, built new ones from tubes found in another wrecked radio set. However, these were too large to be concealed in Buchanan's wooden leg, so they were built into the false top of a stool used by the prisoners. This stool was left out where it was constantly under the very eyes of the prison guards. However, this set did not work too well, so the prisoners rebuilt it into the soles of a pair of bath clogs, which had extremely thick wooden soles, over which they put extra crepe rubber soles. Still later, the set was hidden in the hollowed-out end of a teakwood beam in the ceiling of their quarters. Buchanan's set never was discovered. —30—

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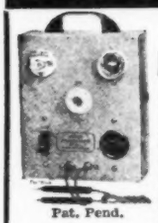

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across R_1. With signal applied (negative as required) the diode conducts and causes a positive voltage drop across R_2 which causes the picture tube to brighten. The amount of diode current is, as in the case of the video output tube grid discussed previously, dependent on the peak of the sync tip and, therefore, on the average content of the signal. Thus, again, the blanking level is held constant and the average bias varies with signal content.

A second method utilizes the variations in the screen current of a pentode output stage to establish the blanking level. In this method, the instantaneous variations are coupled through the capacitor from the plate of the output tube and the d.c. level is direct-coupled from the screen circuit. Thus, the change in average grid bias with change in signal content causes the screen current to vary. In turn, the screen voltage shift changes the bias on the picture tube.

(To be continued)

FM Radio Relay
(Continued from page 55)

quency carrier wave. In unattended and portable equipment, use of the phase-shift method of frequency modulation allows direct crystal control of the mean carrier frequency.

Of particular interest is the crystal oscillator, which operates at 1/96th of the carrier frequency. Carrier frequencies range from 70 mc. to 99.9 mc. in 100 kc. steps; so low-drift CT crystals are provided from 729.17 kc. to 1041.67 kc. in steps of 1.0417 kc.

The output of the crystal oscillator is small and subject to variations due to modifications in crystal frequency and activity. The oscillator output is fed through a limiting amplifier so that it can deliver a strong signal of constant amplitude to the phase modulator, one triode section of a 6SL7GT.

The output of the audio amplifier is coupled to the grid of the 6SL7GT phase modulator. While the plate circuit of this tube (the phase modulator) is untuned, it is terminated in a high impedance r.f. choke.

There are two ways in which radio frequency voltage is fed from grid to plate of the phase modulator. The first is through direct grid-to-plate capacity; the other by electronic amplification of the tube. By means of an unby-passed cathode resistor, degeneration in the cathode circuit keeps the two voltages nearly equal and slightly less than 180° out of phase. As the bias is varied by the audio circuit, magnitude of the electromechanically amplified voltage varies. This results in a current in the r.f. choke of the plate circuit which is varying in phase and frequency. Upon modulation, the frequency is multiplied ninety-six times by a frequency tripler, quadrupler, and three doublers.

Features of the *receiver*, growing out of the special requirements for the relay system, include good image

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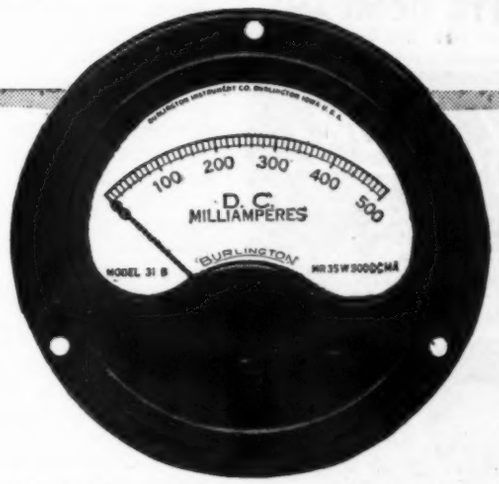

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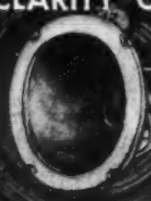

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rejection, high selectivity, stability to match that of the transmitter, and a good squelch circuit.

The receiver operates on any pre-set channel in the frequency range of 70 to 99.9 mc., and receives FM signals to a maximum deviation of ± 30 kc.

Employing 16 tubes, it has a crystal-controlled, double-conversion superheterodyne circuit to attain maximum selectivity and image rejection. To correspond with each transmitting crystal is a receiving crystal, ground so that the receiver oscillator frequency equals the transmitting frequency plus 5 mc., divided by two. (Actually, the crystal frequency is within 1/5th or 1/6th the oscillator frequency).

This same heterodyning frequency is used in the receiver for the two successive frequency conversions of the signal frequency.

For tuning and adjustment of the radio receiver, a test oscillator is employed, using the same crystals as the transmitting set. It supplies a signal at the carrier frequency, enabling the operator to line up the receiver with the aid of a built-in metering circuit. It is self-modulated at 1000 cycles by an audio oscillator.

The efficient squelch system compensates for two factors—the rectified first limiter grid current, and the high frequency noise components of the discriminator output. Under no-signal conditions, a small negative voltage is applied to the squelch control circuit due to fluctuation noise. At the same time, the fluctuation noise present in the receiver causes a positive voltage to be generated and applied to the squelch control circuit. Sharp pulses of interference do not open the squelch. In use, it has been found that a one-microvolt signal can open the squelch, but that noise pulses of considerable amplitude can not. The squelch circuit can be varied in sensitivity, to allow rejection of abnormally high noise levels.

The receiver, as the transmitter, has an additional audio channel for monitoring. Input to this channel is in parallel with the input to the wideband audio channel. In the plate circuit of the monitor amplifier, a low-pass filter allows only the voice frequencies of channel No. 1 to pass into the monitor speaker.

The *amplifier* (AN/TRA-1) increases the output of the radio transmitter to approximately 250 watts. This is done in a single-stage class "C" amplifier, utilizing two HK-257-B power pentodes, in a push-pull-tuned grid-tuned plate circuit requiring no neutralizing adjustment.

Being a push-pull class "C" radio frequency amplifier, it requires an external source of power for filament, bias, screen, and plate voltages. These voltages are most often supplied by the separate power supply, PP-13/TRA-1. The latter gives the required 100 volts d.c. bias, plus 450 volts at 40 ma., and plus 2000 volts at 250 ma.

As an integral part of the system, the *antenna* includes all the equip-

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The antenna itself has a half-wave dipole radiator with a parasitic reflector and a director, spaced approximately one-quarter wave. All of the elements are readily adjustable as to length, without tools, to tune the antenna to any frequency between 70 and 99.9 mc.

There are sixteen *crystals* with each transmitting and each receiving set—eight in the 70 to 80 mc. range, and eight in the 90 to 100 mc. range. Each terminal set has, in addition, a bank of six hundred transmitting and three hundred receiving crystals, providing 300 channels.

Two methods of *operation* of the radio relay system are possible—simplex (one-way) and duplex (two-way). Simplex operation (push-to-talk) makes use of one transmitter, one receiver, and usually one antenna at the terminals, with the transmitter and receiver normally tuned to the same frequency. On different frequencies, two antennas may be used to bring about high antenna efficiency and directivity. However, if extreme ranges are not required, one antenna tuned to the transmitting frequency is sufficient.

Duplex operation requires separate antennas for transmitter and receiver, each operating on different frequencies, because simultaneous transmission and reception are involved. Antennas are separated by fifty or more feet to prevent blocking of the receiver by the transmitter.

If duplex terminal stations are separated too far for direct communication, duplex repeater stations may be inserted at intervals in the system to *relay* the signals. Each duplex repeater station includes two transmitters, two receivers, and four antennas, since operation is required in two directions simultaneously, necessitating the simultaneous use of four different frequencies.

Relay stations may also be used in the simplex system to relay communications between two simplex terminals separated too far for direct communication. With only one relay station, the same receiver and transmitter may be employed to relay in both directions, provided that a bi-directional or omni-directional antenna is employed. Only two frequencies are required. The transmitters at *both* terminals and the receiver at the relay are tuned to frequency f_1, and the transmitter at the relay and the receivers at the terminals adjusted to frequency f_2. If more than one relay station is employed, the relay stations become more complex, each requiring

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two receivers and two transmitters, and frequency assignments become more complicated.

"Its far-flung applications in a global war being fully demonstrated, and with continual enlargements in its scope regularly taking place, the AN/TRC-3(and AN/TRC-4) is another wartime development that is bound to have considerable application in a peacetime world," states Elmer Crane, vice-president of the radio division of *Lear, Incorporated.*

The radio relay may be called upon to serve in remote or isolated areas when disasters strike or wire lines are down. As in battle, radio relay equipment can be easily transported into impractical or heretofore impossible-to-reach sections.

But a disaster is not necessary to prove radio relay's possibilities. In construction or development projects demanding additional telephone facilities, this system can be used to supplement existing wire lines until additional lines can be built. Numerous other uses for the radio relay equipment will be found.

No section of the earth need be, nor ever again will be, beyond communications when a system of the nature of the radio relay is available.

—30—

The Proximity Fuse

(*Continued from page* 51)

tubes to meet these requirements. After many failures, a tube was developed which would take the tremendous abuse to be encountered. This tube appeared to have the possibility of being manufactured by mass-production techniques.

Basically, the proximity fuse finally adopted consists of a five-tube transmitter and receiver. Operation is as follows: The transmitter sends out a signal which is radiated by the small antenna in the nose of the fuse. The radiation pattern of this signal is essentially the same as the bursting pattern of the shell. As long as the shell is travelling through free space with no objects in the vicinity, the transmitter continues to operate with no corresponding receiver action. However, as a target is approached, the radiated signal is reflected by the target and changes the radiation resistance of the antenna. As this resistance changes, a pulse is set up in the plate circuit of the oscillator, due to the varying load. This pulse is passed through an audio amplifier and, when it reaches sufficient intensity, is used to trigger a miniature thyratron tube. In the plate circuit of the thyratron, a squib consisting of a resistance wire encased in explosive is used. As the plate current of the thyratron starts suddenly when the grid reaches its operating potential, this resistance wire heats up, causing the explosive to ignite. This explosive, in turn, sets off a firing charge which is used to detonate the shell.

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The distance at which the reflected signal is strong enough to set off the shell varies from 10 to 70 feet, depending on the size of the target. It can readily be seen that the reflected signal will, in all cases, be very weak, so that a large amount of audio amplification will be necessary. One of the greatest problems was that of sufficient audio gain with little or no microphonics. A high order of microphonics would have defeated the purpose, as these microphonics in themselves would have, automatically, set off the fuse.

Many problems in addition to satisfactory tubes beset the designers. Among these was the necessity for a source of power that did not deteriorate while the fuses were in storage. Ordinary dry batteries were satisfactory as far as the power went, but had the disadvantage that the life in storage was only the shelf life, while under tropical conditions their life was so short as to make them impractical. After much experiment, a battery essentially the same as the dry type was developed, in which the electrolyte was contained in a small glass vial which shattered as the shell was fired from the gun. The electrolyte then ran into the battery, which was built in circular form, activating it and in this manner turning on the unit. Batteries made in this way have a very long shelf life, as there is no chemical action until they are activated.

One of the essentials of any fuse is that it protect the shell against premature explosion. If the fuse is likely to explode prematurely, there is much danger in handling it previous to its use. What is needed is some method of rendering the shell inactive until it is in motion. This was solved in the proximity fuse by means of a centrifugally operated switch which kept the *squib* shorted until the shell had been fired. The switch consisted of a small container of mercury, together with a porous diaphragm of powdered nickel. As the shell rotated after leaving the gun, the mercury was forced through this porous diaphragm by the centrifugal action, removing the short from the *squib*. This permitted the squib to be fired by the thyratron when the thyratron was triggered by the reflected signal.

At the beginning these fuses were developed for use by the Navy. However, the Army soon evidenced interest in this type of fuse.

One of the main factors in any new weapon is that of surprise. It was essential that the enemy be prevented from capturing any duds that might fall where they could be recovered. The Navy originally issued orders that none of these fuses could be used where duds might fall on land. However, it was apparent that if the fuses were to have wide application for land as well as sea fighting, some other method would have to be used. Accordingly, the fuses were fitted with detonating mechanisms that exploded on contact in the event the shell missed the target or failed for some other cause.

An additional safety feature was also incorporated in the fuse. This was a reed spin switch which is normally closed and only opened by centrifugal force. When the shell is at rest this switch shorts the thyratron condenser used to furnish the necessary firing current when the thyratron is triggered, opening the circuit when the shell rotates rapidly enough. As the shell's rotation diminishes in flight, the reed gradually closes. By this time the mercury safety switch has unshorted the squib, and the condenser discharges through the squib when the thyratron is triggered. The purpose of this reed switch is twofold: it serves as a safety device prior to the firing of the gun, and it provides a means of self-destruction for projectiles that miss their target or fail to detonate, thus preventing their recovery by the enemy.

The effectiveness of the shells was first demonstrated in 1943, when 75 per-cent of the rounds fired by Naval 5" guns were time-fused projectiles, while 25 per-cent were proximity-fused. Of the airplanes shot down in this period, 49 per-cent were credited to time fuses and 51 per-cent to proximity fuses. These figures establish an advantage ratio of 3 to 1 for proximity fuses. Improvements in proximity fuses since that time have resulted in raising this ratio considerably. The

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relative size of a target as it appears to a proximity fuse is over 50 times that of a standard *contact* projectile.

Extensive tests and combat use of proximity-fused howitzer ammunition by the U. S. Army established the devastating effect of air bursts on light equipment, and especially on personnel not under adequate cover. This opened up consideration of proximity fuses for use in shore bombardment at all ranges, and the fuses were used for this purpose occasionally in the Pacific theater. Air bursts of proximity-fused projectiles could be used against light topside equipment and exposed personnel on decks of enemy ships. The course of the war in the Pacific did not provide opportunity for this use of the fuse, however.

The proximity-fused projectile's margin of combat advantage over a contact fuse is even greater than over a time fuse. A comparison between the use of the contact-fused 40 mm. antiaircraft projectile and the proximity-fused 5" projectile shows this clearly. Since for contact fuses the shell must actually strike the airplane to detonate, the lethal burst area of a 40 mm. projectile for an approaching airplane is quite small—about 60 feet square. The average lethal burst area of a proximity-fused 5" projectile is much larger for the same airplane—about 5000 square feet, since the shell will be detonated if it passes within a radius of 75 to 100 feet of the plane.

One of the most important uses of the proximity fuse was in the war against the buzz bombs that the Germans unleashed on Britain in June 1944. The following report from the official U. S. Army observer indicates clearly that proximity-fused antiaircraft projectiles were dramatically effective in shooting down the V-1 bombs:

"The first employment of VT fuses against the enemy came with the first launching of the V-1 flying bombs against London on 12 June 1944. The antiaircraft at first played a minor role in the defenses, being allowed to fire only when the weather was such that fighter planes could not operate. . . . By the first of July it became evident that the defense system could be improved by allowing antiaircraft firing VT fuses to engage targets without interference from the fighter planes. Consequently, during the second week of July all antiaircraft weapons were moved to the Channel coast, where the fields of fire were mainly over ocean areas and where the bursts would not be dangerous to civilian personnel. From mid-July until mid-August, when the main V-1 attack ceased, some 500 heavy antiaircraft guns were free to engage all flying bombs approaching the coast. These weapons included five battalions of 90 mm. guns operated by U. S. Army personnel. The remainder were British 3.7" batteries. 90 mm. guns began employing VT fuses from the day they were moved into position. By the first

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(*Continued on page* 158)

week of August, practically all heavy weapons on the Channel coast were employing VT fuses.

"The result of the advent of VT fuses was truly sensational increases in *kills*. For the last four weeks of the now famous 80 days of V-1 attacks, the record of antiaircraft was as follows: During the first week 24 per-cent of all targets engaged were destroyed; the second week, 46 per-cent destroyed; the third week, 67 per-cent destroyed; and the fourth week, 79 per-cent destroyed.

"The last day in which a large quantity of V-1's were launched against England, 104 were detected by early warning radar, but only four reached London. About 16 failed to reach the coast, having malfunctioned over France or the Channel . . . while antiaircraft accounted for 68."

A total of something over ten million of these fuses were produced during the years of 1943 and 1944. No figures are available for the year 1945, but it is probable that several million more were made in this period. When it is considered that each fuse contains five tubes along with the other component parts, the tremendous production job that was done in utmost secrecy can be seen. Few of the workers had any idea of the ultimate use of the tubes or other parts, and it was only through the greatest care that the job was carried to a successful completion without valuable information reaching the enemy.

—30—

For the Record

(Continued from page 8)

has the profession been hampered by the shortage of new and improved instruments necessary to speed their work.

Thousands of you are seeking to replace battered instruments which have seen yeoman service during the war years. Now that you should be in position to step into your jobber's show room and choose these vital tools of your trade from a wide array of new scientific devices, you, too, are frustrated. Yes, sir, it's plenty aggravating. Save your money, though, fellows; there are some wonderful instruments coming your way in '46.

SPEAKING about aggravations, our companion publication, *Radio & Appliances*, had its share when they found their first issue, planned for November, strike bound as a result of the typographers strike in the Chicago area. There they were, all closed, ready to publish when the boys walked out of the printing plant.

Ed DeNike, the managing editor, said he felt like he'd just reached the top of Radio City, was about to step out on the observation platform, when somebody cut the elevator cables.

Joe Marty, Jr., the associate editor, who had been burning the midnight oil to say nothing of the rails and

New STATION CALLS OR *Old?*

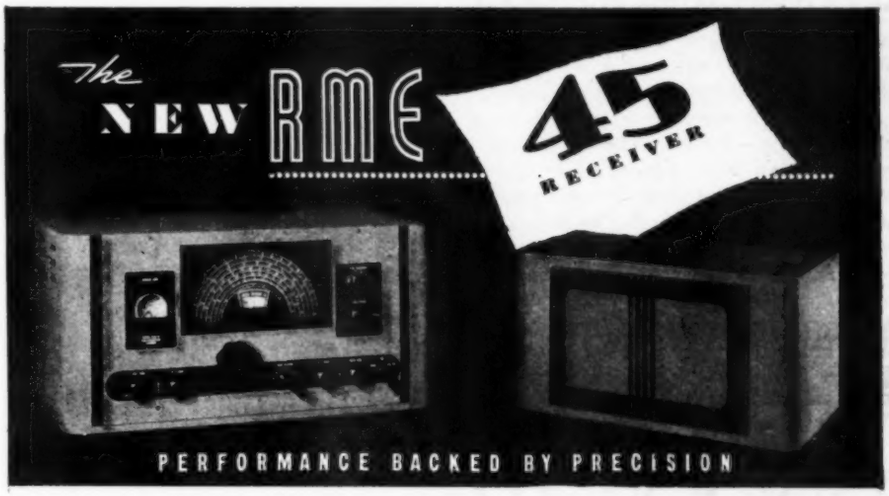
Regardless of the proposed changes in postwar call areas, you'll call for RME communications equipment when planning your new station.

While producing for war—RME and its staff of engineers developed gear that will best serve the amateur or commercial operator during postwar.

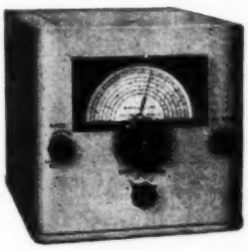
Take the new RME 45, for example. It delivers peak performance on ALL frequencies—500 to 33,000 KC.

The new VHF-152 is another illustration. To make VHF operation really practical when amateur activity is resumed, the new VHF-152 Converter was designed to fill this need.

Just as RME was the first to introduce an R meter in a receiver, so it has continued to pioneer with the finest first!



VHF-152 CONVERTER



For VHF operation on 28 to 30 MC, 50 to 54 MC and the new 144 to 148 MC band. At modest cost, the VHF-152 far exceeds any present day method for working these frequencies, through the **double detection method.**

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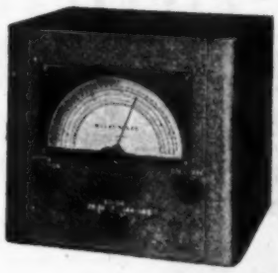
Over-all gain of from 20 to 25 db is achieved throughout the entire tuning range of 550 to 33,000 KC, covered in six bands. The DB-20 gives true preselection—optimum gain with best signal to noise ratio.



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To write articles on transmitters, receivers, antennas, test equipment, and any material of general interest to amateurs. Articles should be typewritten, between 2000 and 2500 words in length, accompanied by suitable diagrams, photos, and parts lists. Liberal payment made upon acceptance.

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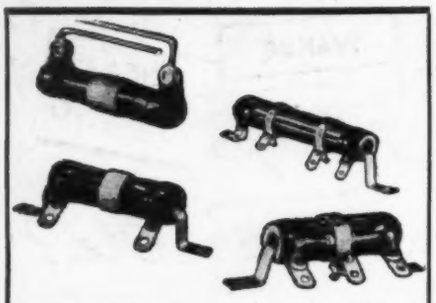

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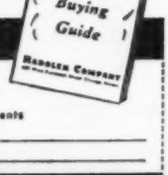

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wires gathering material for the issue looked like a fellow with moth holes in his parachute just after a landing—really let down.

Paul Wendel, merchandising editor, is still wondering why he climbed 46 floors to our office in the Empire State Building during the New York elevator tie-up just to make sure editorial material got out on time.

WE WONDER whether instead of spelling it reconversion, it shouldn't be reCONVERSATION. What a sorry plight that radio, the one industry which probably had the least problems, should find itself in a state of suspended animation. . . . . O. R.

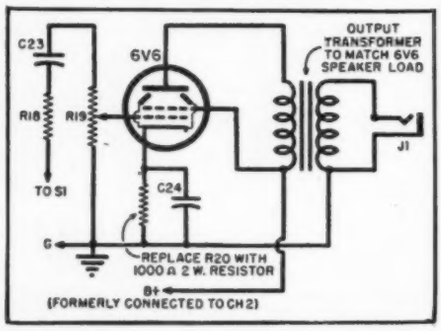
V.h.f. FM-AM Receiver

(*Continued from page* 31)

AM reception, set the FM-AM switch at FM and, using the same generator set up, adjust the secondary trimmer of the discriminator transformer (painted red) for the null point. This null point will be rather sharp with definite peaks on either side of the proper setting. After obtaining the null position, tune the signal generator to one side of the 4.3 mc. i.f. frequency, leave it set at the peak obtained, and adjust the primary trimmer of the discriminator transformer for maximum output. Switch the FM-AM switch back to the AM position before proceeding with the i.f. amplifier alignment.

Two methods may be used to align the r.f. section. The first and simplest way consists of setting the oscillator tuning condenser at half capacity, loosening the couplers between each condenser in the gang, and rotating the detector and r.f. amplifier condensers separately until the background noise in the headset reaches a maximum, indicating maximum sensitivity. Keep in mind that the oscillator operates at a frequency 4300 kc. lower than the detector frequency, and, if there should be two peaks, be sure to align the detector at the peak which occurs at the lowest capacity setting of the condenser. If there is considerable difference in the capacity settings of the detector and r.f. amplifier con-

Fig. 2. If additional power output is desired the 6C5 and audio choke (CH_2) may be replaced with a 6V6 tube, and an output transformer properly matched.



(*Continued from page* 156)

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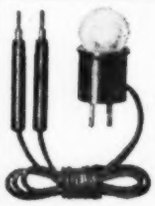

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densers at alignment, the spacing of the detector and r.f. amplifier coils will have to be altered. If the setting is lower in capacity than that of the oscillator, the turns should be separated, and if it is higher, the turns should be squeezed closer together. When alignment of the two stages is accomplished, the coupler set screws are again tightened and your receiver is ready for the air test. The second method of alignment follows along similar lines to the first except that a signal generator is connected to the antenna terminals of the receiver, the gang condenser is set at about ¾ capacity, and the signal generator is tuned to the receiver frequency. The couplers are then loosened as before and the detector and r.f. amplifier peaked on the signal generator signal instead of the background noise. This method obviously provides a more dependable indication of resonance and permits calibration of the receiver at the same time. If the signal generator available will not reach the 88 to 140 mc. range, harmonics may be used just as effectively, except that precautions must be taken to pick up the right harmonic.

When working properly the receiver is a very sensitive device, provided a high *Q* antenna system is connected to it. A poor antenna will destroy all of the gain obtained through the use of the 956 acorn tube in the r.f. amplifier stage. There are many types of antenna designs, both simple and complicated, in the present-day literature. Select one which meets your needs and enjoy the best the v.h.f. has to offer.

Although the new FM band is not ready for public broadcasts as yet, coils may be readily wound for the present FM band or, if you are interested in amateur activities, the 112 mc. range will be available to you with this receiver. There are also a few experimental airport stations working on *blind* landing systems around 126 mc. which make good test signals while waiting for the new FM bands to go into action.

—30—

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Plastics in Radio

(*Continued from page* 28)

ready reflected in the announced plans of British and American manufacturers to put into production in the near future full lines of plastics-housed AM and FM broadcast and vision receivers, phonographs, loudspeakers, and other electronic products incorporating some of the latest developments and refinements in the radio and plastics fields at the lowest possible prices but in the widest possible ranges of colors and designs.

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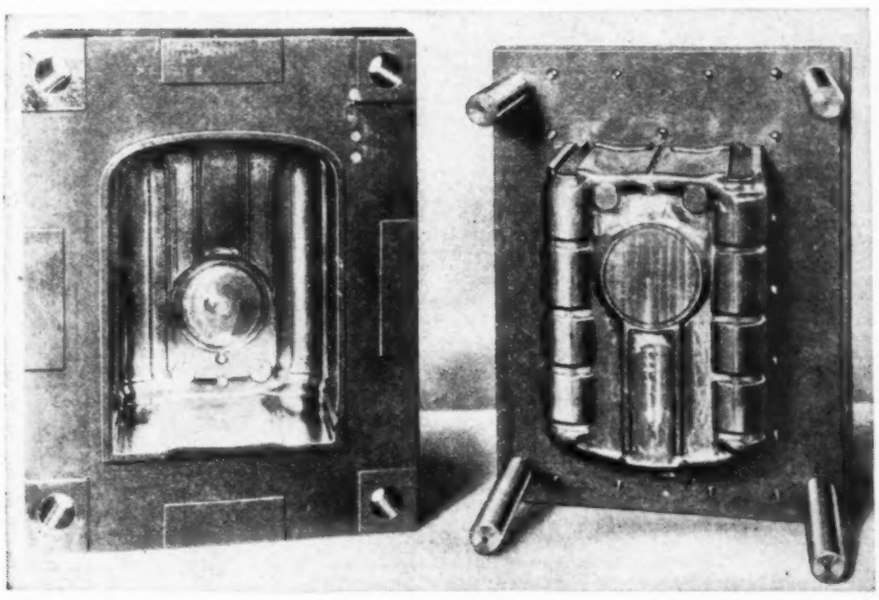
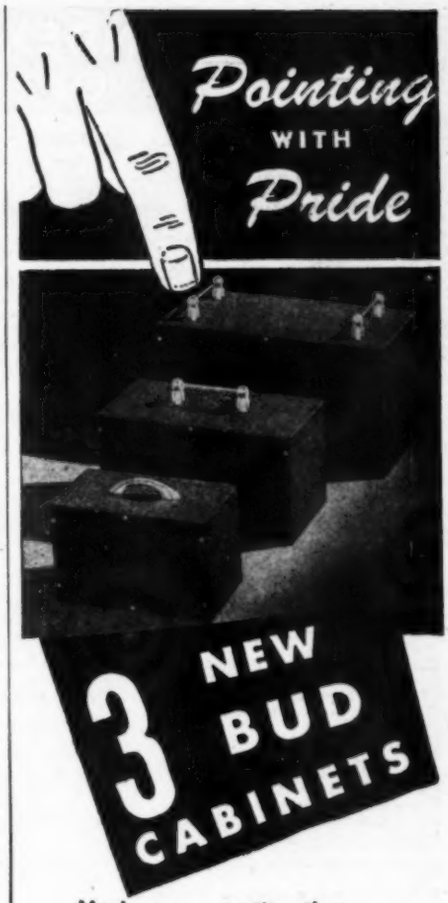
Machine-produced radio cabinet mold of heat-treated nitralloy steel.





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Cabinets are extremely useful for portable or fixed electronic test equipment, small transmitters and receivers, field strength meters, or for other applications requiring a cabinet of outstanding appearance and durability.

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● With tiny silvered micas, it's precision: capacitance tolerances of 1%, with temperature coefficients and stability requirements to meet the highest characteristics requirements of JAN-C-5; excellent retrace characteristics; practically no capacitance drift with time; exceptionally high Q. Yes, Aerovox *specializes* in such precision capacitors.

And at the other extreme are giant Type 26 oil-filled capacitors for high-voltage requirements such as in X-ray equipment, high-voltage test and laboratory equipment, and for carrier-current coupling. Again, Aerovox *specializes* in high-voltage oil-impregnated, oil-filled capacitors.

But how, you ask, can one organization really *specialize* in such totally different products? The Aerovox answer:

The huge Aerovox plant is really *several* plants in one. Micas are made in the Mica Department, oils in the Oil Department, electrolytics in the Electrolytic Department, and so on. Each has its OWN engineers, supervisors, trained workers.

Thus you are assured of that *specialized* craftsmanship that insures the best in highly specialized products, along with the convenience, certainty and economy of ONE outstanding source of supply.

● ***Try us on that capacitance problem***

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The New Model CA-11

SIGNAL TRACER

Simple to operate . . . because it has only ONE *connecting cable- NO tuning controls!*

Introduced in 1939-1940 Signal Tracing, the "short-cut" method of Radio Servicing quickly became established as the accepted method of localizing the cause of trouble in defective radio receivers. Most of the pre-war testers (including ours) were bulky requiring a number of connections before the unit was "set for operation" and included a tuned amplifier which had to be "retuned" to compensate for signal shift.

The new Model CA-11 affords all the advantages offered by the pre-war models and only weighs 5 lbs. and measures 5"x6"x7". Always ready for immediate use without the necessity of connecting cables, this amazingly versatile unit has NO TUNING CONTROLS.

Essentially "Signal Tracing" means following the signal in a radio receiver and using the signal itself as a basis of measurement and as a means of locating the cause of trouble. In the CA-11 the Detector Probe is used to follow the signal from the antenna to the speaker—with relative signal intensity readings available on the scale of the meter which is calibrated to permit constant comparison of signal intensity as the probe is moved to follow the signal through the various stages.

Features

- ★ **SIMPLE TO OPERATE—only 1 connecting cable—NO TUNING CONTROLS.**
- ★ **HIGHLY SENSITIVE—uses an improved Vacuum Tube Voltmeter circuit. Tube and resistor-capacity network are built into the Detector Probe.**
- ★ **COMPLETELY PORTABLE—weighs 5 lbs. and measures 5"x6"x7".**
- ★ **Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.**
- ★ **Provision is made for insertion of phones.**

Please place your order with your regular radio parts jobber. If your local jobber cannot supply you kindly write for a list of jobbers in your state who do distribute our instruments or send your order directly to us.

The Model CA-11 comes housed in a beautiful hand-rubbed wooden cabinet. Complete with Probe, test leads and instructions.....Net price

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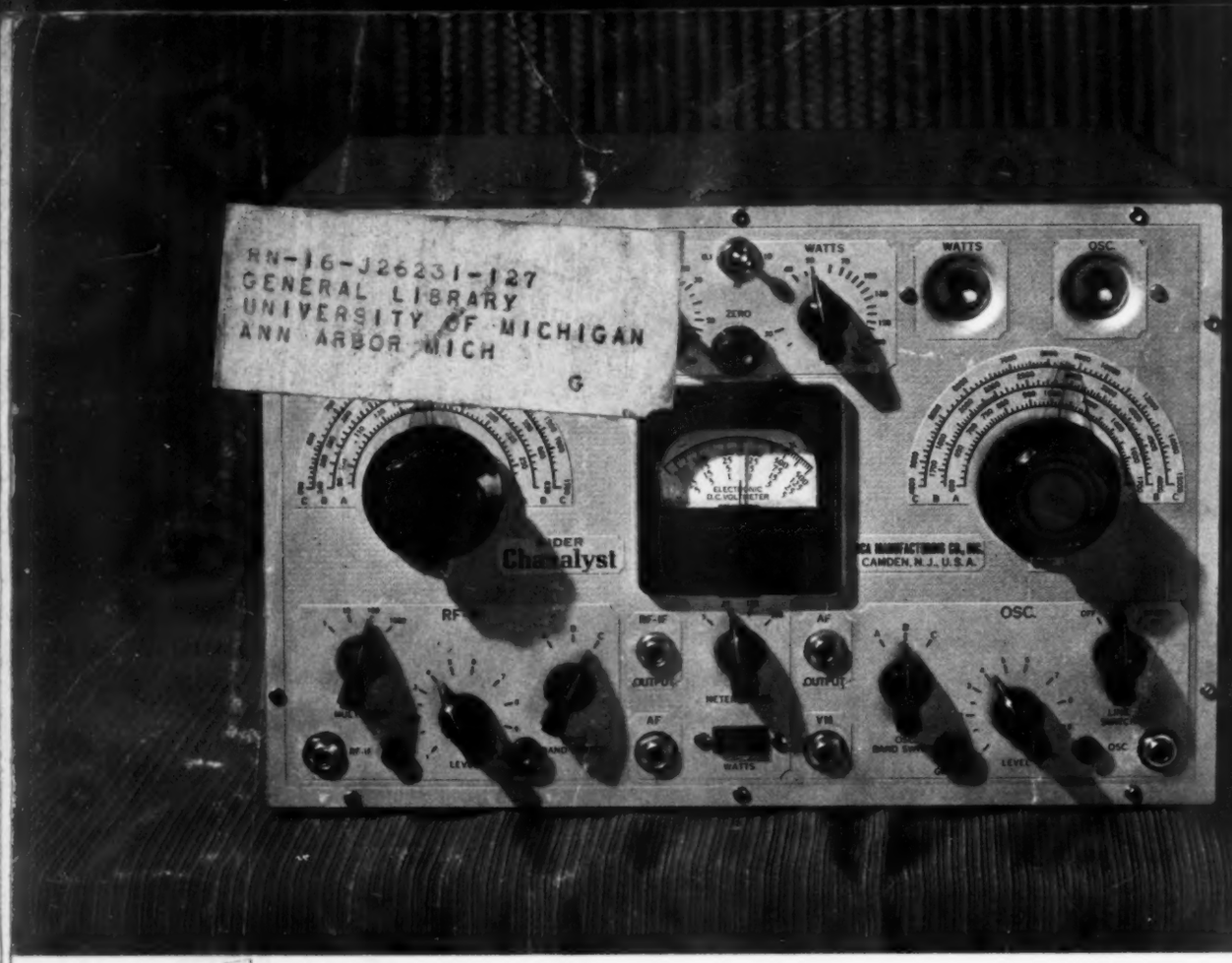

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Panel-Type fuse holders, 10 for	1.39
Panel-Type Neon Holders complete with bulb, 6 for	1.79
Plugin Dry Electro. Capacitor, 40-40 mfd., 250 V. DC, 6-prong mtg. bracket inc.	.59
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Cut & Tinned hookup wire, 10 lbs. for	3.69
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110 V. Dry Rectifier, Half-wave	1.95
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Meter Rectifiers, Half-wave	.95
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Dynamotors (Original Cost $416), Input 24 V. DC @ 13 A. Outputs —300 V. DC @ 26 MA, 150 V. DC @ 100 MA, and 14.5 V. DC @ 5 Amps, with voltage regulator and built-in filter system. Complete	9.95
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Power Transformer, 110 V. AC primary. Secondaries: 1500 V. AC CT, two 6.3 V. AC and a 5 V. AC. Includes two 20 Hy 300 MA chokes. Entire Lot, complete	7.95

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Per 1,000 feet
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SPECIAL OFFER!

22 Gauge twisted pair consisting of 2 stranded wires, tinned copper shield and waxed cotton braid overall.

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Stranded tinned copper conductor, high dielectric insulation, with closely woven tinned copper shield overall. Ideal for shielded lead-in or wherever electrostatic shield is necessary. Put up in 500 foot metal spools.

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sales promotion service. Mr. Davis joined *Cannon Electric* in 1941 as a member of the sales-engineering staff. He holds both an electrical and civil engineering degree from the University of California.

* * *

GEORGE O. CROSSLAND has taken over the post as district manager of the *Capehart Division, Farnsworth Television & Radio Corporation,* in the Philadelphia area.

Mr. Crossland's new territory will include Virginia, Maryland, Delaware, District of Columbia, the eastern section of Pennsylvania and the southern half of New Jersey. He will have charge of the distribution in this area of the new *Capehart* and *Panamuse* phonograph-radio instruments.

He is a graduate of Indiana University and has been serving as assistant manager of the sales division with headquarters in Fort Wayne.

* * *

L. W. HOWARD, formerly vice-president in charge of engineering for a West Coast transformer manufacturing company, has purchased the inventory and equipment of the *Electronic Components Company* and with O. D. Perry has formed the *Triad Transformer Mfg. Co.,* with offices and plant at 423 N. Western Avenue, Los Angeles 4, California.

Mr. Howard, who has had 16 years' experience in the transformer business, will have charge of engineering and sales and Mr. Perry, one of the founders of *Electronic Components Co.,* will be in charge of production.

The new company will manufacture specialized transformers for the radio, aviation, geophysical and other electronic fields.

* * *

SHERMAN K. HUGHES has been named general manager of the *Mark Simpson Manufacturing Company* of Long Island City, New York, manufacturers of sound systems.

Prior to joining the *Simpson* organization, Mr. Hughes was, for many years, associated with the *Jensen Manufacturing Company* of Chicago.

His appointment is in line with the new expansion program at *MASCO* which among other things includes the expansion of manufacturing facilities of the company. A recently erected 30,000 square foot factory in Long Island City will increase the production space of the company.

-30-

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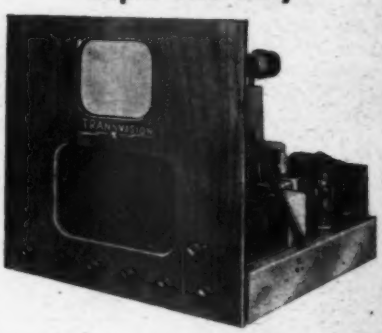

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3. **Pre-tuned R-F unit.**
4. **Finished front panel.**
5. **All solder and wire . . . and sixty feet of low loss lead-in cable.**

Operates on 110V.; 50-60 cycles A.C.

Price: complete with ALL tubes, $159.50. Shipment will be made approximately 4 weeks after receipt of order. $25.00 deposit required on all orders, balance C.O.D.

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